INDUSTRY REPORT ON AI, IOT & BLOCKCHAIN

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GLOBAL & USA MACROECONOMIC OUTLOOK

1.1.   Global Economic Outlook

The global economy in 2025 is steady but slow, with industrial and emerging market leadership balancing softness in mature economies. The IMF has moderately upgraded its 2025 growth forecast, citing resilience in the face of trade uncertainty and uneven macro conditions. Global real GDP growth is projected at 3.0% in July 2025, up from 2.8% in April 2025, and expected to reach 3.1% in 2026. Emerging and developing economies are forecasted to grow at 4.1% in 2025, moderating slightly to 4.0% in 2026.

While global growth remains below pre-pandemic norms, the upgrade reflects improved financial conditions, reduced tariff tensions, and fiscal support in select economies. Growth disparities persist—the strongest outlook is in Emerging Markets, especially China and India, while advanced economies remain sluggish. Policy uncertainty, trade disruptions, fiscal constraints, and geopolitical instability pose tangible downside risks to the baseline outlook. Despite modest upward revisions in global growth forecasts to 3.0% in 2025 and 3.1% in 2026, the recovery remains fragile and exposed to significant geopolitical and environmental headwinds.

Geopolitical conflicts, trade disputes, and tariff escalations are disrupting supply chains, dampening investment sentiment, and contributing to global economic fragmentation. Heightened U.S.-China trade frictions, regional conflicts in Eastern Europe and the Middle East, and rising defense expenditures have further strained fiscal resources and increased uncertainty across markets.

Simultaneously, environmental challenges—including the intensification of climate-related disasters such as floods, droughts, and wildfires—are imposing significant economic costs, especially on climate-vulnerable nations. These events are exacerbating food and energy price volatility, damaging infrastructure, and heightening fiscal pressures in emerging and low-income economies. The uneven pace of the green energy transition and inadequate climate adaptation investments add further risk to long-term global stability.

Together, these intertwined geopolitical and environmental pressures are amplifying inflationary risks, distorting trade and investment flows, and threatening to derail the fragile recovery. The IMF underscores the urgent need for coordinated global policies to strengthen resilience through climate adaptation financing, trade diversification, and conflict mitigation efforts to sustain economic stability.

Inflation continues to play a critical role in shaping global economic dynamics in 2025, even as headline rates moderate. While global inflation is projected to decline to 4.2% in 2025 (IMF), it remains above pre-pandemic levels in many economies, with uneven regional impacts. High inflation reduces real incomes, particularly in lower-income households, curbing consumer spending, which is a key driver of economic growth. Persistent food and energy price pressures disproportionately affect emerging markets and vulnerable populations. To control inflation, major central banks (e.g., U.S. Federal Reserve, ECB) have maintained tight monetary policies, including higher interest rates. This has raised borrowing costs globally, slowing investment, credit growth, and housing markets.

While the IMF expects inflation to gradually ease, sticky core inflation in major economies (e.g., U.S., Eurozone) keeps monetary policy restrictive. Emerging economies must balance inflation control with growth needs, as over-tightening risks deepening slowdowns. Structural factors—geopolitical conflicts, climate shocks, and supply chain fragmentation—continue to inject inflationary pressures globally.

1.1.1.   Global GDP Growth

The IMF's July 2025 Growth forecast projects global GDP growth at 3.0% in 2025, up from April's 2.8%, and 3.1% in 2026, supported by front-loaded trade activity, improved financial conditions, and fiscal support in key economies.

Global growth for 2024 had been approximately 3.3%, which the IMF notes is still stronger than the current year's projection but set the baseline for moderation into 2025.

Advanced economies are expected to grow at 1.5% in 2025 and 1.6% in 2026, with the United States upgraded to 1.9% and 2.0% for 2025 & 2026, driven by tax stimulus and strong domestic demand, while the Euro Area is forecasted to grow at 1.0% and 1.2% amid easing energy pressures.

Emerging and developing economies remain the primary growth engines, expanding 4.1% in 2025 and 4.0% in 2026, led by India, the fastest-growing major economy, at 6.4% in both years and China (raised to 4.8% in 2025, moderating to ~4.2% in 2026) with robust domestic demand and infrastructure investment. While the forecasts reflect underlying resilience, growth momentum among emerging economies is partly driven by front-loaded trade activity ahead of tariff hikes, which may fade by late 2025. Continued policy uncertainty, tariff volatility, geopolitical friction, and climate-related shocks remain key downside risks, particularly for developing economies with limited fiscal buffers.

Japan's economy experienced negative growth of 0.2% in 2024 as per the latest IMF report, but the GDP growth is forecasted at 0.7% in 2025, and 0.5% in 2026. This improvement is attributed to strong corporate profits and wage gains, which are expected to bolster consumption and capital expenditures. Notably, the IMF observes that Japan is approaching the Bank of Japan's 2% inflation target sustainably, marking a significant shift after decades of near-zero inflation. However, potential downside risks include global economic slowdowns and reduced domestic consumption.

Indonesia's economic outlook is generally positive, with sustained growth hovering around 5% (5% in 2024, 4.7% in 2025 & 2026) in the 2024-2026 period expected over the coming years, and also with strong growth prospects in digital economy and green energy sectors. Indonesia's economic resilience is driven by robust domestic demand, a growing middle class, and increasing investment in infrastructure and digital technologies. However, the country faces challenges such as global market volatility, environmental risks, and structural reforms that need to be addressed.

The Middle East and Central Asia region is projected to grow by 2.4% in 2024, with an acceleration to 3.4% in 2025 and further to 3.5% in 2026. This positive outlook is based on the expected gradual reversal of oil production cuts and the easing of temporary disruptions to oil production and shipping. Nevertheless, the region remains susceptible to geopolitical tensions and fluctuations in global oil demand, which could impact economic stability. IMF includes the counties of Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan as the Central Asia region, also referred to as the Caucasus and Central Asia (CCA).

The economic outlook for the region is cautiously optimistic, with key countries focusing on diversification and structural reforms to reduce dependence on oil revenues. Nations like Saudi Arabia are leading this shift by investing heavily in sectors such as renewable energy, tourism, and technology, particularly under initiatives like Saudi Arabia's Vision 2030. While oil prices continue to play a critical role in the region's economies, there is growing momentum towards sustainability and innovation.

Emerging and developing economies continue to be the global growth engine, with a solid baseline forecast of 4.1% in 2025. Gains in the forecast reflect improved external conditions, particularly in China and India. However, much of the near-term resilience stems from shifted trade timing and temporary fiscal or monetary support. As these effects dissipate, these economies may face headwinds from evolving trade policies, fiscal constraints, and environmental or geopolitical disruptions.

Exhibit 1: Global GDP Growth, CY 2015-26 (in %)
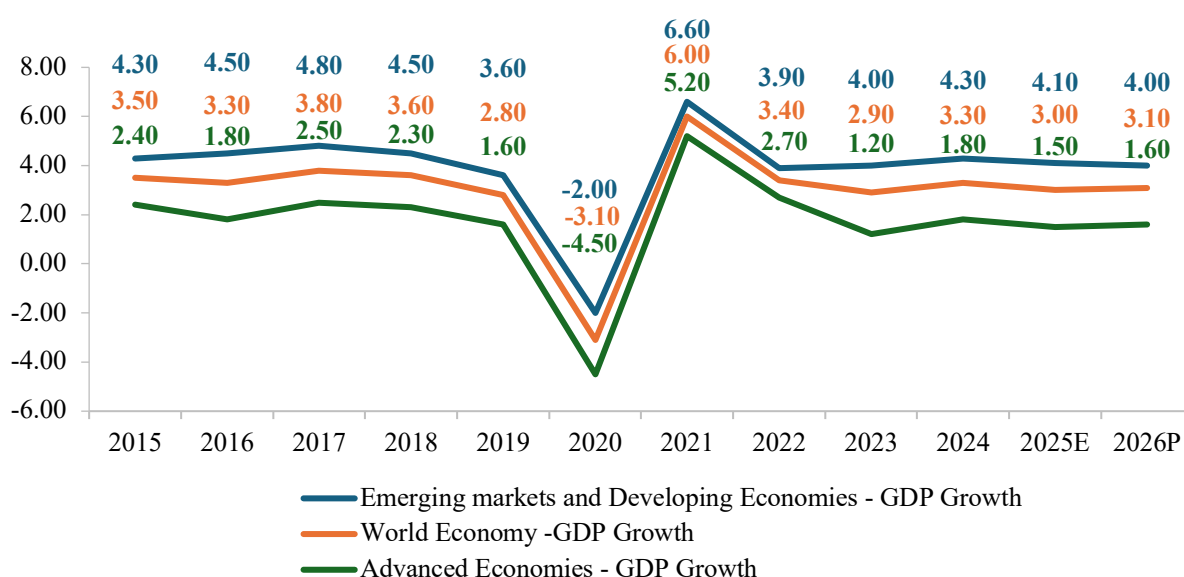
Note: Advanced economies include regions such as United States, Germany, France, Italy, Spain, Japan, United Kingdom

Emerging economies include regions such as China, India, ASEAN-5, Russia, Brazil, Mexico, Saudi Arabia, Nigeria, South Africa

Source: IMF, World Economic Outlook (WEO), July 2025

Global inflation is expected to ease to 4.2% in 2025 and 3.6% in 2026, though it remains above pre-pandemic levels, while global trade growth is forecast at 2.6% in 2025, before slowing to 1.9% in 2026 amid tariff uncertainty and fragmentation. The IMF cautions that risks from geopolitical tensions, trade disputes, climate-related disruptions, and persistent core inflation could undermine this fragile recovery, highlighting the need for coordinated policies to support stability and resilience.

Advanced economies: The IMF's latest update signals slightly improved prospects for advanced economies, but growth remains modest and well below pre-pandemic averages. As part of its World Economic Outlook Update, the IMF projects growth for advanced economies to reach 1.5% in 2025 and 1.6% in 2026. This represents a modest upgrade of 0.1% point for each year compared to the April 2025 forecast, reflecting a broadly positive but fragile economic environment. For United States growth rate is forecasted to reach 1.9% in 2025 and 2.0% in 2026, up from April estimates. The revisions are supported by lower-than-expected tariffs, improved financial conditions, currency depreciation, and fiscal stimulus through U.S. tax reforms (One Big Beautiful Bill Act, or OBBBA), estimated to raise output by ~0.5% through 2030. For Euro Area, growth rates has been revised upward to 1.0% growth in 2025 (0.2 % above April), then to 1.2% in 2026. The higher 2025 forecast is largely attributable to a spike in Irish pharmaceutical exports driven by trade front-loading, though Ireland constitutes under 5% of eurozone GDP. Foe Other Advanced Economies (excluding U.S. & Eurozone), growth rates are projected to expand at 1.6% in 2025, rising to 2.1% in 2026. The slower 2025 pace is attributed to currency appreciation and selective tariff hikes (e.g. on autos and steel), though financial conditions remain broadly favorable. Example: South Korea (IMF downgraded its 2025 growth forecast for South Korea to 0.8% (a 0.2 % cut from April), but raised its 2026 outlook to 1.8%).

Emerging and developing economies: The IMF projects growth of 4.1% in 2025, easing slightly to 4.0% in 2026 for emerging market and developing economies, marking an upward revision from earlier estimates of 3.7% in 2025. China's growth was upgraded to 4.8% in 2025, down slightly to ~4.2% in 2026, reflecting stronger-than-expected early 2025 activity and a significant reduction in U.S.–China tariffs. India remains the fastest-growing major economy, with 6.4% growth in both 2025 and 2026, revised upward in light of more favorable external conditions. While the forecasts reflect underlying resilience, growth momentum among emerging economies is partly driven by front-loaded trade activity ahead of tariff hikes, which may fade by late 2025. Continued policy

uncertainty, tariff volatility, geopolitical friction, and climate-related shocks remain key downside risks, particularly for developing economies with limited fiscal buffers.

Emerging and developing economies continue to be the global growth engine, with a solid baseline forecast of 4.1% in 2025. Gains in the forecast reflect improved external conditions, particularly in China and India. However, much of the near-term resilience stems from shifted trade timing and temporary fiscal or monetary support. As these effects dissipate, these economies may face headwinds from evolving trade policies, fiscal constraints, and environmental or geopolitical disruptions.

1.1.2. Factors affecting GDP growth rate of Key Select Economies

Recent US-India tariff dispute and its impact on the Indian economy

The recent tariff dispute between the United States and India has emerged as a significant challenge for the Indian economy. Triggered in part by India's continued oil trade with Russia, the U.S. has imposed higher tariffs—up to 50%—on several Indian exports, including textiles, gems and jewellery, leather, seafood, and auto components. These sectors, many of which are labor-intensive, are now facing reduced competitiveness in the U.S. market, threatening jobs and export revenues. As a result, India's GDP growth may slow by an estimated 0.3% to 0.6% this fiscal year. The trade imbalance is also expected to widen, exerting pressure on the rupee and potentially impacting inflation. While the Indian government is exploring policy measures to cushion the blow—such as tax adjustments, export incentives, and market diversification—the medium-term risks remain significant. Prolonged tariffs could undermine India's manufacturing push, reduce foreign investment, and erode its position in global supply chains. The dispute underscores the importance of strategic diplomacy and economic resilience as India navigates an increasingly complex global trade environment.

The ongoing U.S.-China geopolitical and economic competition remains the most significant global risk in 2025. Despite partial tariff rollbacks earlier in the year, persistent uncertainty surrounding U.S. trade policy continues to disrupt global trade flows and strain supply chains. The tech decoupling, driven by U.S. export controls on semiconductors and AI technologies, has intensified China's efforts toward technological self-sufficiency, further fragmenting global innovation networks. Meanwhile, geopolitical alliances are deepening polarization, with the U.S. advancing its Indo-Pacific strategies and China expanding its Belt and Road Initiative (BRI), compelling other economies to navigate an increasingly divided global landscape.

Russia-Ukraine Conflict and European Security Risks

The Russia-Ukraine war continues to strain Europe's energy markets, disrupt agricultural exports such as grain and fertilizer, and impose heavy fiscal burdens related to defense and humanitarian aid. Despite efforts to diversify away from Russian gas, energy price volatility persists, undermining industrial competitiveness and fueling inflation. At the same time, rising defense spending across NATO countries is diverting resources from social programs and long-term investments, further complicating the region's economic stability and growth prospects.

Middle East Instability : Ongoing geopolitical conflict in the Middle East heightens energy price volatility, disrupts trade routes, and raises inflation risks globally. Regionally, it strains investment, tourism, and fiscal priorities while boosting defense spending. Supply chain disruptions, currency pressures, and investor caution slow growth, though energy exporters may see short-term fiscal gains.

The Israel-Hamas/Palestine conflict is exerting growing pressure on the global economy through multiple channels. Energy markets have been particularly sensitive, with oil prices rising amid fears of supply disruptions in the Middle East — a critical hub for global oil production and trade routes like the Suez Canal and Strait of Hormuz. If the conflict escalates or spreads regionally, the risk to global energy supplies and shipping lanes could intensify, driving inflation and raising costs across global supply chains. Central banks, already managing post-COVID inflation, may be forced to maintain high interest rates longer, dampening economic growth. Investor sentiment has weakened, especially in emerging markets and Gulf states, with stock markets reacting to rising geopolitical uncertainty. Locally, Israel faces increasing military spending and economic slowdowns in key sectors like tourism, while Gaza's economy has nearly collapsed due to infrastructure destruction and severe humanitarian conditions. The IMF and World Bank have warned that if tensions continue or spread, the conflict could negatively impact global growth forecasts, especially in energy-dependent and trade-sensitive economies.

Global Trade Fragmentation : Geopolitical rivalry is driving "friendshoring" and reshoring, leading to parallel trade blocs (U.S.-aligned vs. China-aligned) and reduced efficiency in global value chains. WTO's weakened role limits dispute resolution, and rising protectionism (tariffs, subsidies) further impedes multilateral trade. The IMF estimates trade fragmentation could shave 1.5% off long-term global GDP if current trends persist.

Geopolitical Competition in Technology & Resources : Control over critical minerals (lithium, cobalt, rare earths) needed for green energy and high-tech manufacturing has sparked geopolitical contestation in Africa, South America, and Asia. Competition for dominance in AI, quantum computing, and cybersecurity is intensifying economic nationalism and curbing international collaboration.

Global South Political and Debt Crises : Many developing economies face debt distress, exacerbated by tighter global monetary conditions and reliance on external financing. Political instability in parts of Africa, Latin America, and Southeast Asia, often linked to resource nationalism or governance crises, further undermines investor confidence.

The IMF emphasizes that geopolitical tensions are now a core structural risk to the global economy, intertwined with trade fragmentation, technology decoupling, and climate policy. Without coordinated frameworks, these risks could lead to slower global growth (3.0% in 2025) and heightened financial instability. The IMF urges multilateral cooperation, renewed WTO engagement, and targeted support for emerging markets to cushion the economic fallout.

1.1.3. Impact of Emerging Technologies on the World Economy

Emerging technologies are significantly reshaping the world economy by driving productivity, transforming industries, creating new markets, and influencing labor dynamics. The IMF highlights that emerging technologies are becoming a central driver of global economic transformation, influencing productivity, trade, labor markets, and investment patterns. Advances in AI, automation, and digital platforms are significantly improving efficiency across industries, reducing costs, and creating new markets. Generative AI and advanced analytics are reshaping services and knowledge work, while blockchain, fintech innovations, and digital payments are accelerating the shift toward cashless economies and improving financial inclusion.

In manufacturing and trade, automation, robotics, and 3D printing are transforming global value chains by reducing dependence on low-cost labor markets and promoting regionalized production. Meanwhile, green technologies, including renewable energy, electric vehicles, and energy storage solutions, are driving sustainable investment and reshaping energy markets in response to climate imperatives.

Labor markets are undergoing profound changes as automation displaces routine tasks while creating demand for high-skill digital roles, particularly in emerging economies integrating into the global digital economy. This is fueling a need for widespread reskilling initiatives to prevent widening inequality between digitally advanced economies and those lagging behind.

Furthermore, technological leadership has become a geopolitical determinant, with competition in AI, semiconductors, and green tech influencing trade flows and investment priorities, particularly between the U.S. and China. While emerging technologies are projected to add over $15 trillion to global GDP by 2030, the benefits remain unevenly distributed, emphasizing the importance of digital infrastructure investment, policy support, and international cooperation to ensure inclusive growth in this rapidly evolving landscape.

Some of the key areas where the emerging technologies impact the world are :

Boosting Productivity and Efficiency : AI and Automation streamline manufacturing, logistics, and services, reducing costs and increasing efficiency across sectors. Generative AI is transforming knowledge work (finance, healthcare, legal services), boosting output while reducing routine tasks.

Driving Innovation and New Markets : Technologies like blockchain, quantum computing, and IoT are creating new industries (e.g., Web3, autonomous logistics) and revenue streams. Digital platforms have enabled global e-commerce, fintech, and decentralized finance, broadening access to financial and business services.

Labor Market Transformation : AI-driven automation is displacing routine jobs but creating demand for high-skill roles in tech development, cybersecurity, and data science. There is an increased focus on reskilling and upskilling, especially in emerging economies integrating into the digital economy.

Impact on Trade and Global Value Chains : Advanced manufacturing (3D printing, robotics) reduces reliance on low-cost labor markets, reshaping global supply chains. Digital trade and cross-border data flows are now key components of international trade, making technology a driver of globalization.

Financial Sector and Digital Payments : Fintech, CBDCs (Central Bank Digital Currencies), and blockchain-based systems are redefining payment infrastructure and improving financial inclusion. This shift accelerates the transition toward cashless economies, impacting monetary policy and regulatory frameworks.

Geopolitical and Economic Competition : Technological leadership has become a strategic driver of geopolitical power, with U.S.-China competition in AI, semiconductors, and green tech influencing global trade and investment patterns.

Sustainability and Green Technology : Renewable energy technologies, EVs, and energy storage are reshaping energy markets, reducing fossil fuel dependence, and driving climate-related investment. Climate tech is projected to be a multi-trillion-dollar sector by 2030, aligning sustainability goals with economic growth.

1.1.4.   Edge Data, Blockchain, AI, IoT and World Economy

Edge Data enhances real-time efficiency by processing information closer to its source, reducing latency and enabling instant decision-making in sectors such as manufacturing, healthcare, and logistics, while lowering reliance on cloud infrastructure. It lowers cloud costs and bandwidth dependency, democratizing access to digital services in emerging markets. By 2030, edge computing and edge data are projected to contribute over $400 billion annually to the global economy through efficiency gains, cost reductions, and new digital markets (as per industry estimates). Economies adopting edge data infrastructure are likely to see accelerated competitiveness in AI-driven industries, positioning themselves as leaders in the digital economy.

Blockchain is revolutionizing financial systems through decentralized finance (DeFi), cryptocurrencies, and central bank digital currencies (CBDCs), improving supply chain transparency (e.g., agriculture, pharma by verifying origin and reducing fraud), and reducing transaction costs via smart contracts and enabling cross-border trade efficiency. By 2030, blockchain-enabled efficiencies could unlock $1–1.5 trillion in value globally, according to IMF-linked studies.

Artificial Intelligence, including generative AI, is boosting automation, driving automation and productivity gains, reducing labor costs in routine tasks while boosting efficiency in industries like healthcare (diagnostics), finance (fraud detection), and retail (personalization).and enabling data-driven decision-making across industries from healthcare to finance, potentially adding trillions to global GDP.   AI & Generative AI is reshaping knowledge work, content creation, and customer service.

Similarly, IoT is connecting billions of devices, enabling smart homes, cities, factories, and infrastructure that optimize energy use, traffic flow, and utilities. It facilitates predictive maintenance in industries, reducing downtime and operational costs. This strengthens global trade logistics by tracking goods in real-time, improving supply chain resilience.

Together, these technologies are creating synergistic effects, where edge computing enables IoT, AI leverages IoT data, and blockchain secures these ecosystems. They underpin Industry 4.0, driving efficiency, reducing costs, creating high-skill jobs, and reshaping global value chains away from labor-intensive models. According to IMF and World Bank estimates, these technologies collectively could contribute $15–20 trillion to global GDP by 2030, with emerging markets poised to benefit most if digital infrastructure gaps are addressed.

1.1.5. Key Macroeconomic Growth Drivers for Global Economy with specific focus on select regions of USA, Europe and India

Rising Young Population

According to United Nations, there are approximately 1.24 billion people globally aged 15-24 years old (CY2023), representing roughly 15% of the total population. An estimated 40% of the global population falls under the age of 25, highlighting the significant size of the younger generation. Due to income limits, the growing population of young people has a tendency towards financial restraint.

However, estimates show that by 2030, both its sizable population and per capita spending are expected to experience significant rise. With 1.2 billion members worldwide, the youth demographic is the largest generation in history and offers prospects for both labour supply and consumer demand.

Exhibit 2: Global Young Population, CY 1950-2030, In Billion
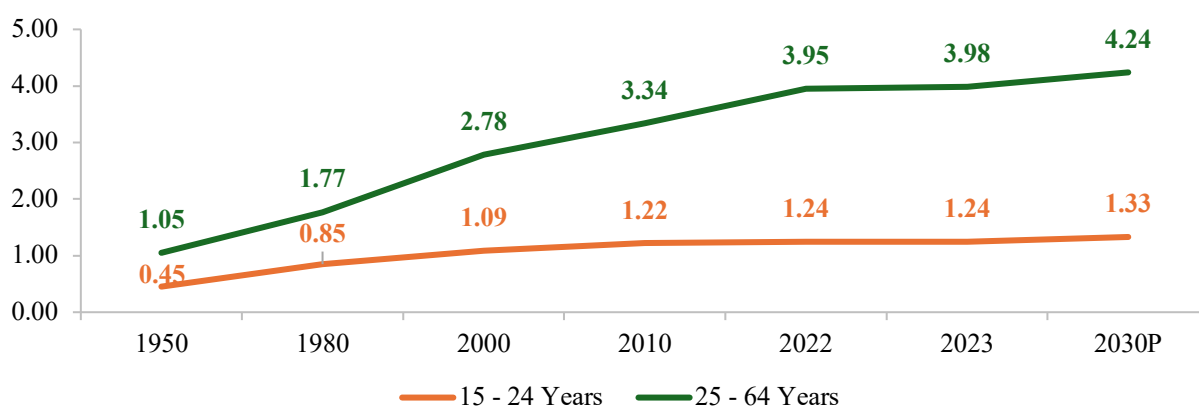
Source: Frost & Sullivan Analysis

Exhibit 3: Global Population Age Structure, CY 1950-2030, In Billion

Source: https://ourworldindata.org/
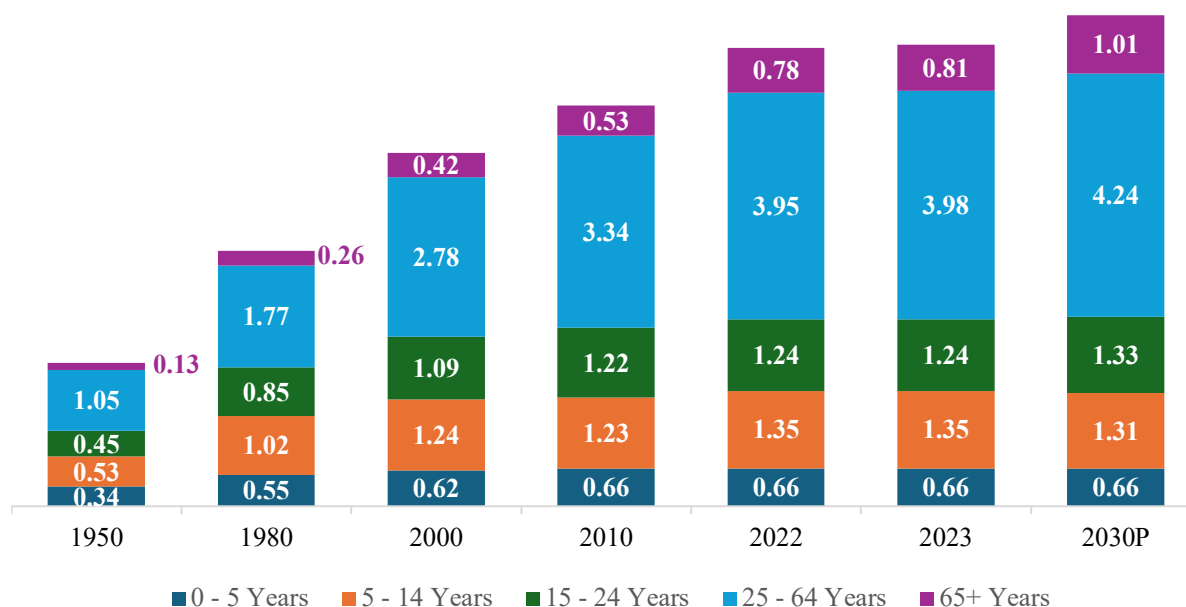
Exhibit 4: Rising Young Population, CY 1950-2030 (MN), USA, Europe & India

USA: Young Population CY1950-2030 (MN)	Europe: Young Population CY1950-2030 (MN)	India: Young Population CY1950-2030 (MN)

USA:
- 177.8 (2030, 25-64)
- 74.6 (1950, 25-64)
- 21.5 (1950, 15-24)
- 44.1 (2030, 15-24)

Legend: ●—15-24 ●—25-64

Europe:
- 380.8 (2030, 25-64)
- 264.4 (1950, 25-64)
- 96.7 (1950, 15-24)
- 82.1 (2030, 15-24)

Legend: ●—15-24 ●—25-64

India:
- 797.7 (2030, 25-64)
- 142.0 (1950, 25-64)
- 68.6 (1950, 15-24)
- 245.7 (2030, 15-24)

Legend: ●—15-24
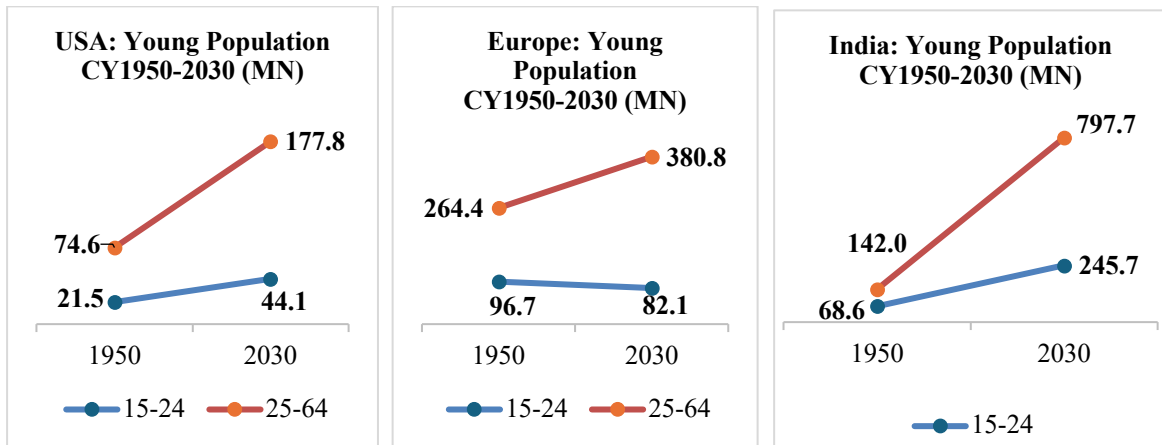
In the USA, the population in the age group 25-64 years is expected to increase over the period of 1950-2030, and reach 178 MN, whereas India is expected to record even a sharper jump increasing its population in the same age group to 798 million in 2030 from 142 million in 1950.

Growing Global Disposable Income:

Exhibit 5: Worldwide annual disposable income - per capita. (In thousands USD)

Year	Value
2019	8.07
2020	8.19
2021	8.83
2022	8.91
2023	9.24
2024*	9.66
2025*	10.12
2026*	10.59
2027*	11.06
2028*	11.55
2029*	11.98
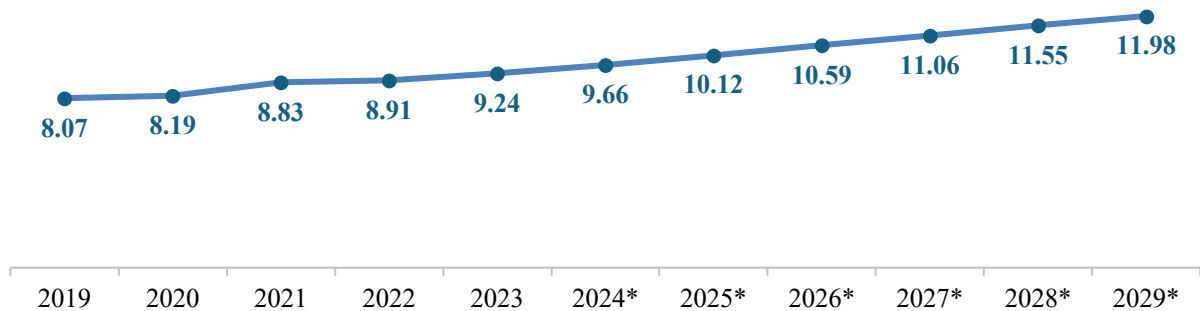
* Forecasted

Source: Statista Market Insights, World Bank, OECD, Eurostat, World Bank PovcalNet, WID - World Inequality Database

The information illustrates a steady rise in global annual disposable income between 2019 and 2029, climbing from USD 8,100 to 12,000. Disposable income significantly influences the extent to which individuals and households allocate funds for different buckets of expenses. Increase in global per capita income growth has significantly increased consumer demand, especially in emerging economies.

Exhibit 6: USA annual disposable income - per capita. (In thousands USD)

Annual disposable income - per capita. (In thousands USD) , 2019 - 2028
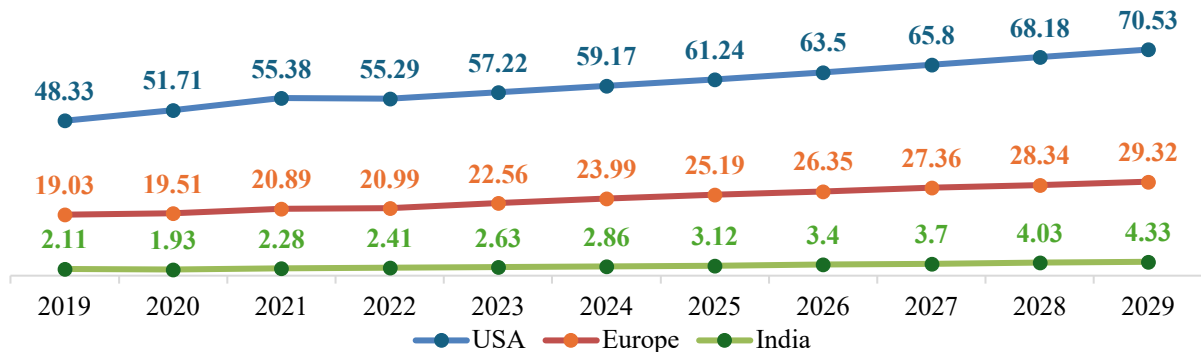
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
USA	48.33	51.71	55.38	55.29	57.22	59.17	61.24	63.5	65.8	68.18	70.53
Europe	19.03	19.51	20.89	20.99	22.56	23.99	25.19	26.35	27.36	28.34	29.32
India	2.11	1.93	2.28	2.41	2.63	2.86	3.12	3.4	3.7	4.03	4.33

Source: Statista Market Insights, World Bank, OECD, Eurostat, World Bank PovcalNet, WID - World Inequality Database

For Europe, the annual average disposable income per capita is expected to increase from USD 19,000 in 2019 to USD 29,300 in 2029. India is expected to double its annual disposable income per capita from USD 2,100 in 2019 to USD 4,300 in 2029.

Increase in Discretionary Spending: As disposable incomes grow, consumers have more resources available to allocate towards discretionary purchases, such as consumer durables, electronics, automobiles, leisure activities, and dining out. This leads to a rise in overall consumption levels and stimulates demand across various sectors of the economy.

Growing Global Consumer Spend

Worldwide Consumer Spending has witnessed an increasing trend from USD 58 trillion in 2023 to reach USD 70 trillion in 2027 and USD 74 trillion in 2028.

Exhibit 7: Global Consumer Spending & across select economies, CY 2019-29, USD Trillion

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Global	48.8	46.6	52.5	55.0	57.7	60.6	63.9	67.2	70.5	74.0	77.2
USA	14.4	14.1	15.9	17.2	18.2	18.9	19.7	20.5	21.3	22.1	23.0
Europe	12.3	11.6	13.0	13.2	14.3	15.1	15.8	16.5	17.1	17.7	18.2
India	1.7	1.6	1.9	2.1	2.3	2.5	2.8	3.0	3.3	3.7	4.0
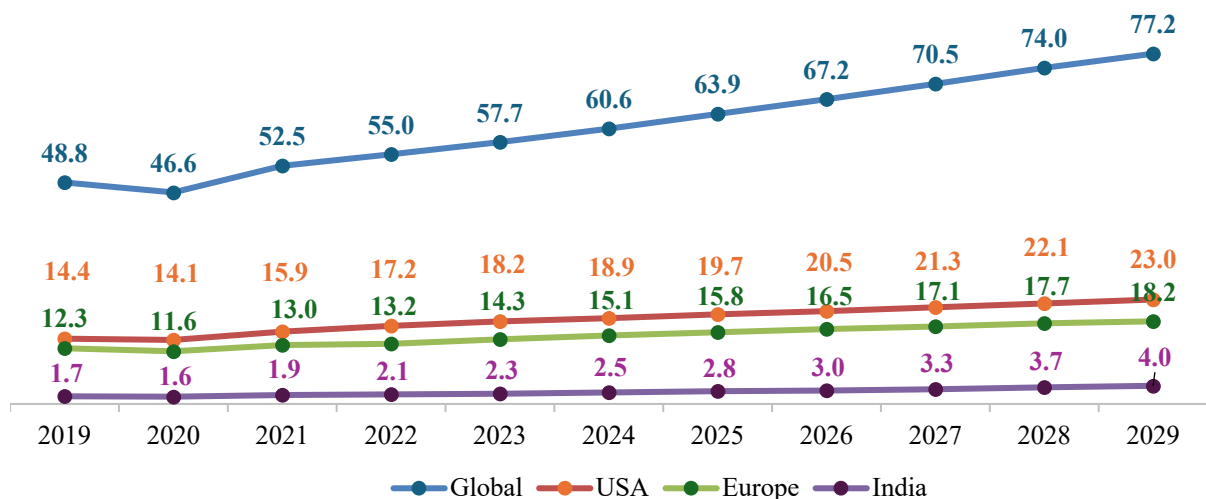
Source: Statista Market Insights, World Bank, IMF, UN, Eurostat

Consumer spending is a significant driver of economic growth. As consumer confidence rises and household incomes increase, individuals are more likely to spend on goods and services, stimulating demand and driving economic activity across various sectors.

1.2. USA Macroeconomic Overview

In 2025, the United States maintains its position as the world's largest economy, with GDP surpassing US$28 trillion, driven by resilient consumer demand, steady business investment, and strategic policy support. Its

economic strength is anchored in high productivity, advanced technological innovation, and a dynamic labor market, which continue to reinforce its global competitiveness. However, underlying challenges such as income inequality, fiscal imbalances, and political polarization remain influential factors shaping the nation's macroeconomic trajectory. Despite these headwinds, the U.S. economy's adaptability, coupled with its strong innovation ecosystem and robust institutional framework, positions it to sustain growth and retain its central role in driving the global economy.

1.2.1. USA – Macroeconomic Variables - GDP Growth and Forecast

Exhibit 8: USA GDP Growth Rates (%), 2017-2026
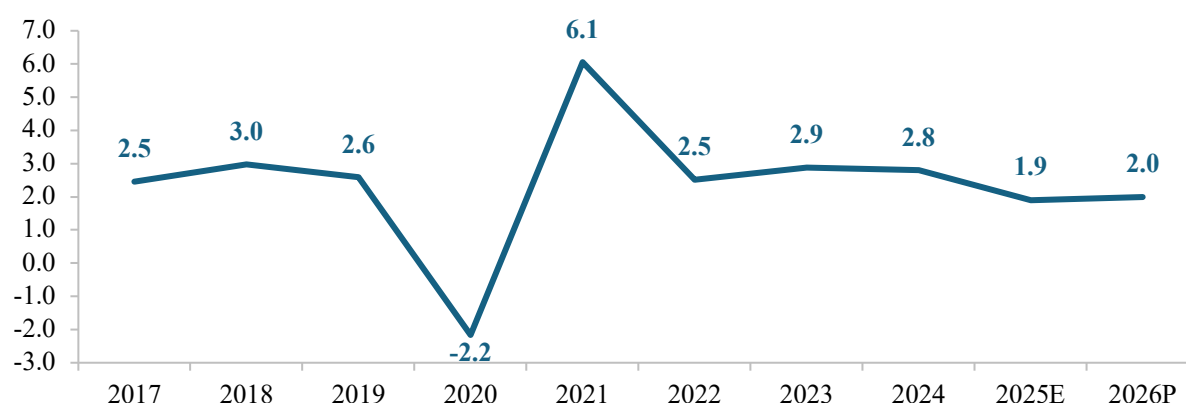
Source: IMF, World Bank

1.2.2. Accelerated Economic Growth & Key Drivers for the Nation's Economy

In 2025, the U.S. economy is projected to grow at 1.9%, reflecting the lagged impact of high interest rates and tighter financial conditions. Consumer spending is expected to remain subdued due to elevated borrowing costs, though wage growth and easing inflation may provide modest relief to household purchasing power. Inflation is forecast to continue its gradual decline but stay slightly above the Federal Reserve's 2% target, particularly in housing and services. Business investment is anticipated to strengthen, driven by strategic sectors such as artificial intelligence, digital transformation, and clean energy, supported by industrial policy measures. However, the broader outlook remains cautious amidst ongoing global trade tensions and potential labor market constraints in select industries. Overall, 2025 is likely to be a year of measured growth and policy recalibration, balancing the Fed's focus on price stability with the need to sustain economic momentum in a moderately cooling but resilient U.S. economy.

US Economy : Key Drivers

Jobs Growth in the USA :According to industry experts, the U.S. economy added approximately 2.2 million jobs in 2024—a solid figure, though notably lower than the 3.0 million jobs added in 2023. The Bureau of Labor Statistics (BLS) reported that 256,000 jobs were added in December 2024 and 212,000 in November 2024. Through June 2025, nonfarm payrolls have increased by roughly 780,000, signaling a slower yet stable labor market in the first half of the year. Looking ahead, the outlook for 2025 points to continued job growth but at a more moderate pace compared to recent post-pandemic years. Projections from the Federal Reserve Bank of Philadelphia suggest monthly job gains will average around 145,000, bringing the annual total to approximately 1.7 million if the trend holds. While the labor market remains resilient, signs of cooling are evident. Job creation in the private sector has softened—particularly in manufacturing and trade-related industries—while sectors such as health care and social assistance remain key drivers of employment. Public sector hiring has helped stabilize the overall job numbers, although federal employment has declined since the beginning of the year.

Exhibit 9: Total Approximate Jobs (Nonfarm payrolls) added in USA, Historical, 2018-2025*
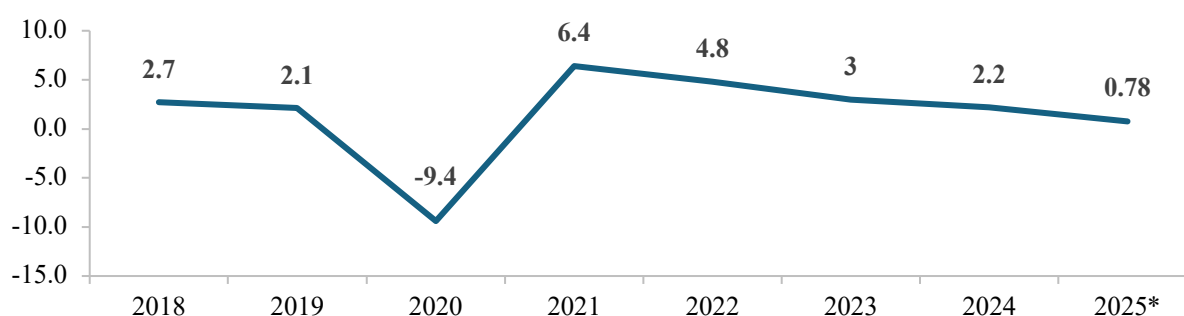
Source: Bureau of Labor Statistics, National Restaurant Association Projections, Secondary sources
Note: Jobs added represents change in employment during the 12 months of the calendar year ; Data for 2025 is until June, 2025

Rising Consumer Spend

According to data from the U.S. Bureau of Economic Analysis, consumer spending rose to USD 16.3 trillion in Q4 2024, up from USD 16.1 trillion in Q3 and USD 15.8 trillion in Q4 2023. As illustrated by ongoing quarterly increases since Q2 2020, consumer spending has not only rebounded from pandemic lows but has now surpassed pre-pandemic levels. Given that consumer expenditure accounts for nearly two-thirds of U.S. GDP, it remains a critical driver of economic output, employment, and growth. In 2025, moderate gains in real disposable income—underpinned by steady wage growth and easing inflation—are sustaining this momentum. However, elevated interest rates, high housing and service costs, and tighter credit conditions are dampening big-ticket purchases and limiting wage gains. While Federal Reserve rate hikes have successfully brought inflation down to 2.1%, they have also constrained income growth, posing a challenge to household purchasing power. Nevertheless, rising disposable income continues to support consumer demand, business revenues, and investment activity, helping to maintain the overall resilience and momentum of the U.S. economy.

Exhibit 10: USA Consumer Spend, CY2019-2024

United States Consumer Spending, 2019-2023 (USD Trillion)
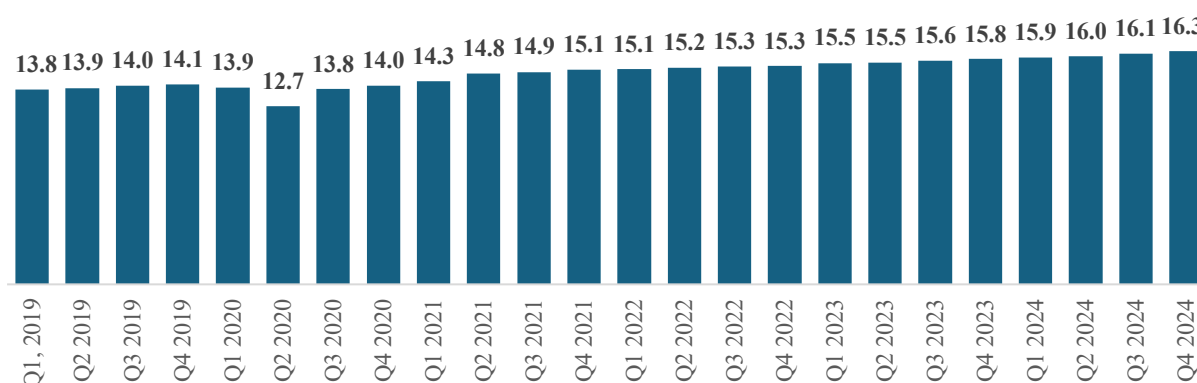
Source: USA Bureau of Economic Analysis, tradingeconomics.com

Exhibit 11: USA Per Capita Disposable Personal Income - CY 2012-2024

USA: Disposable Personal Income, Per Capita (USD, 1000's)

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
39.4	39.1	40.7	42.0	42.9	44.7	47.0	48.9	52.4	56.2	56.4	60.9	63.6
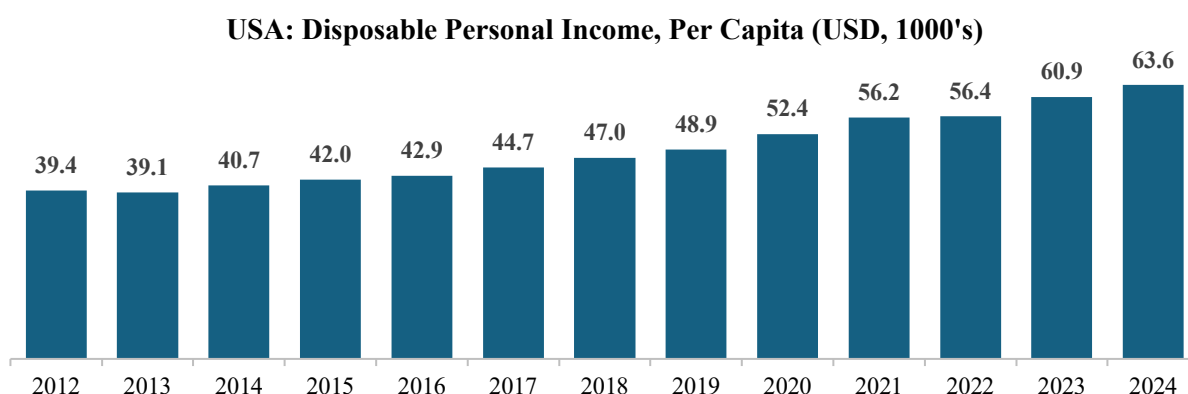
Source: U.S. Bureau of Economic Analysis, tradingeconomics.com

Monetary Policy by the Federal Reserve

The Federal Reserve is maintaining elevated interest rates (4.25–4.50%) to keep inflation in check, which has eased to 2.5% as of April 2025, while supporting moderate GDP growth around 1.9%. By tightening credit conditions and reducing balance sheet liquidity, the Fed has tempered consumer borrowing, housing demand, and business investment, cooling big-ticket spending but helping stabilize prices and real disposable income growth. Looking ahead, the Fed signals potential rate cuts in late 2025 or early 2026 to transition toward a neutral stance that supports sustained economic growth without reigniting inflation. This balanced approach aims to achieve a "soft landing," preserving labor market resilience, steady wage gains, and long-term financial stability.

Exhibit 12: USA Fed Funds Interest Rates %, CY 2021-2025

Feb-21	Feb-22	Feb-23	Feb-24	Feb-25	Jul-25
0.25%	0.25%	4.75%	5.5%	4.50%	4.50%
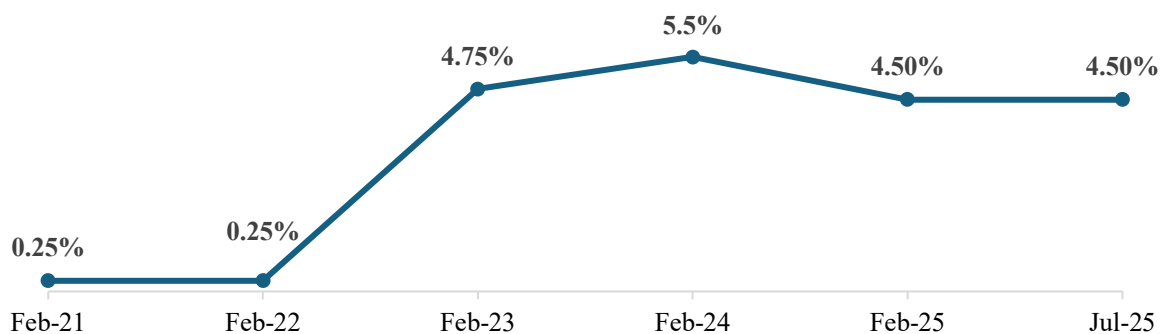
Source: Tradingeconomics

Key demographic trends driving growth in USA

Global IT spending is increasingly influenced by key demographic trends. An aging population in developed countries is boosting investments in healthcare technologies like telemedicine and remote monitoring. Meanwhile, millennials and Gen Z are driving demand for cloud services, collaboration tools, and flexible work solutions. In emerging markets, rapid urbanization and a growing middle class are fueling spending on smart city initiatives and digital infrastructure. For example, the U.S. population aged 65+ has more than doubled since 2000, highlighting the impact of these demographic shifts on technology priorities.

Exhibit 13: USA Population By Age Group - CY 1950-2050
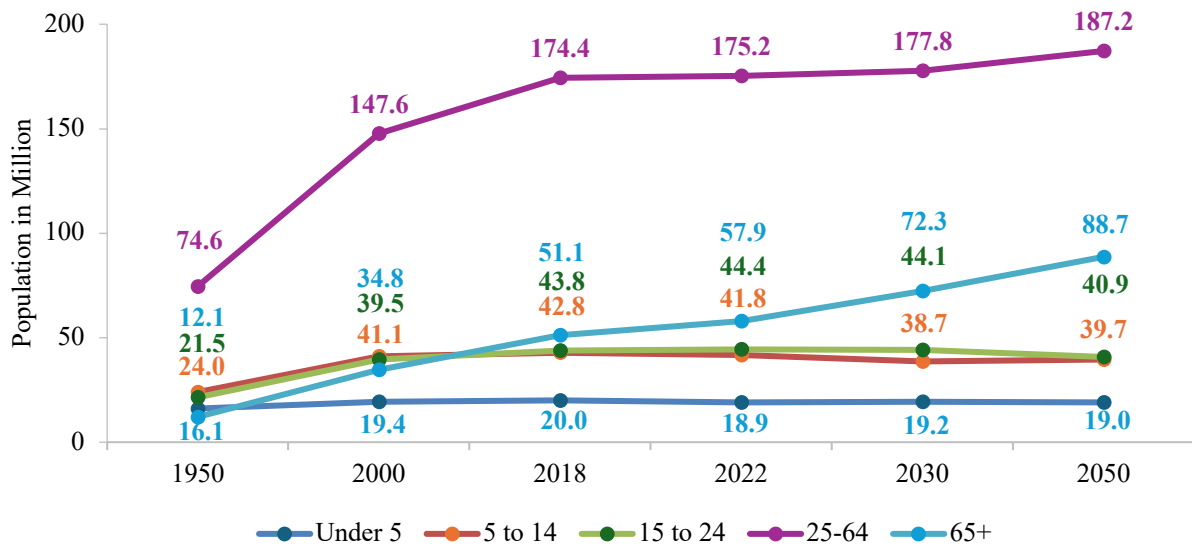
Digital connectivity

The widespread adoption of high-speed internet and the rapid expansion of digital connectivity have deeply transformed various aspects of the economy. This includes changes in e-commerce, remote work opportunities, and the growth of technology-driven industries.

Digital transformation has the potential to stimulate economic expansion and enhance connectivity both within the region and globally. The shift to 5G technology is propelling economic growth in the USA by fostering innovation, productivity, and business expansion. With its faster speeds, reduced latency, and expanded capacity, 5G is poised to revolutionize sectors like healthcare, manufacturing, transportation, and entertainment. Moreover, it is expected to drive job growth, attract investments, and bolster GDP by enhancing efficiency and competitiveness. Overall, widespread adoption of 5G holds significant promise for driving economic prosperity and technological advancement across various industries in the USA.

Exhibit 14: Number of internet users in the United States - CY 2014-2024

No. of individuals using the internet in the USA (Mn)
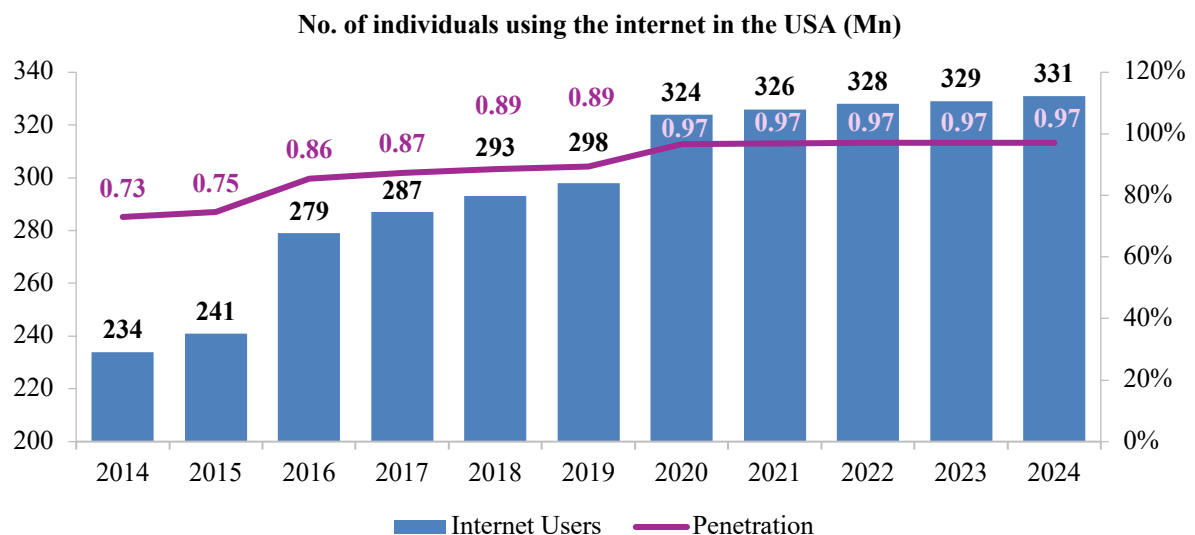
* All numbers are for the month of January in the respective years

Internal Migration & Remote Work Acceleration

Internal migration and the rise of remote work continue to reshape the U.S. economy in 2025. While Sun Belt states like Texas, Florida, and North Carolina still attract residents, growth has slowed, with Midwestern and Snowbelt regions such as Missouri and Wisconsin gaining population due to affordability and milder climates. Remote and hybrid work remain widespread, with about 22.8% of employees working remotely part-time and 40% of job postings offering flexible arrangements. This shift has transformed business operations, prompting increased investments in cloud platforms, collaboration tools, and secure remote access solutions. However, the expansion of remote work has also raised cybersecurity concerns, leading to greater IT spending on endpoint security, multi-factor authentication, and infrastructure upgrades. Together, these trends are driving regional economic shifts, evolving workforce strategies, and fueling IT investments focused on agility and digital resilience.

As the U.S. navigates persistent headwinds from global trade tensions and geopolitical uncertainties, its focus remains on sustaining growth and competitiveness through innovation and strategic policy. The continued integration of advanced technologies to enhance productivity, bolster customer experience, and strengthen digital connectivity positions the U.S. economy to maintain its global leadership. Backed by its strong fundamentals, innovation-driven industries, and prudent monetary and fiscal policies, the United States is expected to remain a cornerstone of global economic growth in 2025 and beyond.

Technology Spend

Technology spend in the USA was USD 2,037 Billon, in 2024 which is anticipated to reach USD 3,411 Billion in 2030 growing at a CAGR of 9.0% in the period of 2024 - 30.

Technology spending in the USA remains robust and is driven by various factors, including digital transformation initiatives, increasing adoption of cloud computing, cybersecurity investments, and advancements in emerging technologies like artificial intelligence (AI) and Internet of Things (IoT). Businesses across industries are investing heavily in upgrading their IT infrastructure, implementing new software solutions, and enhancing cybersecurity measures to remain competitive in the digital age. Additionally, the COVID-19 pandemic has accelerated the pace of technology adoption as organizations transitioned to remote work and digital business models.

Global investments in data center and cloud infrastructure remain strong in 2025, driven by the accelerating adoption of AI, edge computing, and digital transformation initiatives. The U.S. continues to be a dominant hub, attracting a substantial share of these investments due to its advanced infrastructure, skilled workforce, and technology-driven market. Major hyperscale players such as Google, Meta, Amazon, Microsoft, and Oracle have significantly ramped up their capital expenditures to expand cloud and AI capabilities. In 2025, these companies are projected to collectively invest over USD 200 billion, reflecting a continued annual growth trend of around 25–30% over the past five years, fueled by surging demand for high-performance data center services and AI-driven workloads.

Exhibit 15: USA: Total Technology Spend, 2020-30 (USD Bn)
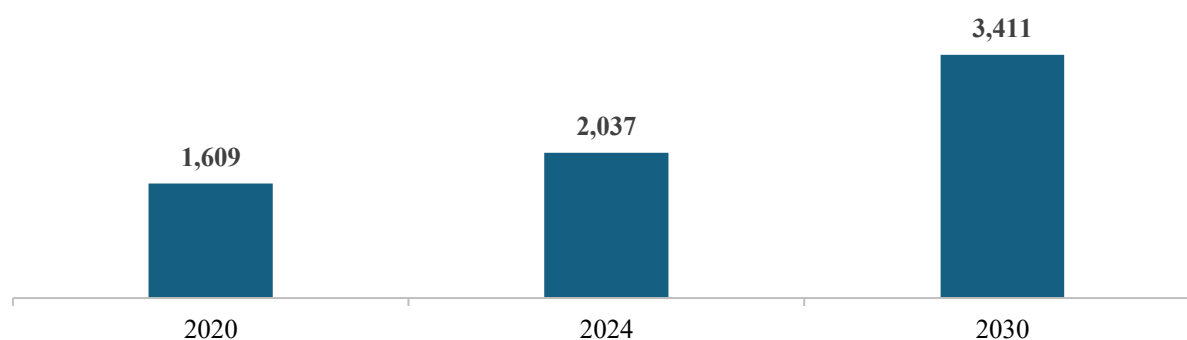
Source: Frost & Sullivan analysis

Technology spending in the USA is expected to continue growing at a CAGR of 9.0% as organizations prioritize innovation and digitalization to drive efficiency, productivity, and growth.

Emerging Technologies as a Catalyst

Emerging technologies particularly AI, edge computing, IoT, and blockchain—are becoming integral to U.S. business strategies and technology spending, driving both operational efficiency and new revenue models. Edge computing is accelerating real-time data processing in sectors like manufacturing, logistics, healthcare, and autonomous mobility, reducing latency and enabling AI-powered decision-making at the source. IoT adoption is expanding in smart factories, connected vehicles, energy grids, and retail, improving asset tracking, predictive maintenance, and customer experience. Blockchain is gaining traction beyond cryptocurrencies, underpinning secure supply chain traceability, digital identity, and decentralized finance applications.

U.S. enterprises are increasing IT budgets to integrate these technologies, with investments often paired with cloud infrastructure, AI, and cybersecurity upgrades. This shift supports productivity gains, cost optimization, and resilience against supply chain disruptions. It also stimulates growth in related industries such as semiconductor manufacturing, data center expansion, and advanced telecom infrastructure. Collectively, these technologies are fostering innovation, boosting competitiveness, and creating high-skill jobs, while reinforcing the U.S.'s leadership in the global digital economy. As adoption scales, their combined impact is expected to contribute materially to GDP growth, particularly through enhanced industrial output, service delivery, and exportable tech solutions.

1.3.   Middle East Macroeconomic Overview

The Middle East's GDP growth has shown significant volatility, reflecting oil market swings, global shocks, and regional dynamics. After modest growth during 2017–2019, the region contracted sharply by –3.2% in 2020 amid the pandemic and oil price collapse. Growth rebounded strongly in 2021 (4.4%) and 2022 (6.1%) on the back of higher oil prices, OPEC+ easing, and post-COVID recovery. However, tighter OPEC+ production cuts, weaker external demand, and ongoing geopolitical tensions slowed growth to 1.7% in 2023 and 1.8% in 2024.

In 2025, GDP is projected to rise moderately to 2.0%, supported by gradual easing of oil output curbs, continued public investment in diversification initiatives (notably in Saudi Arabia and the UAE), and improving non-oil sectors such as tourism, logistics, and technology. Nonetheless, persistent risks like oil price volatility, conflicts in Gaza and the Gulf, and sanctions on Iran are expected to cap upside momentum. Looking ahead, growth is forecast to strengthen to 3.1% in 2026, contingent on greater geopolitical stability, reform implementation, and sustained non-oil sector expansion.

Exhibit 16: ME GDP Growth Rates (%), 2017-2026

Source: IMF, World Bank
P-Projection

Diversification initiatives such as Saudi Vision 2030 and the UAE's investments in tourism, technology, and green energy are driving non-oil sector expansion, which has become a key engine of growth. However, persistent geopolitical instability continues to weigh on investor sentiment and trade flows. Inflation dynamics remain divergent, with GCC economies maintaining price stability through currency pegs and subsidies, while non-GCC

countries like Iran and Lebanon grapple with high inflation and currency pressures. Labor market challenges, particularly high youth unemployment outside the GCC, also constrain domestic demand. Moreover, fiscal policy is split between oil-rich GCC states sustaining large public investment programs and fiscally constrained non-GCC economies struggling with debt and limited financing. Combined with global trade uncertainties and the ongoing energy transition, these factors explain the region's modest 2.0% growth forecast in 2025, with stronger momentum expected only if oil markets stabilize, reforms accelerate, and geopolitical risks ease toward 2026.

1.3.1. Accelerated Economic Growth & Key Drivers, Trends & challenges for Middle East Macroeconomics

The Middle East's macroeconomic outlook in 2025 is shaped by a mix of long-term structural trends and short-term cyclical dynamics, with the region's growth trajectory defined by monetary stability in the Gulf, oil market dependence, rapid digital transformation, diversification initiatives, shifting trade patterns, and persistent geopolitical risks.

Monetary Stability in the GCC vs. Fragility in Non-GCC Economies

The GCC's monetary stability, anchored by the U.S. dollar peg, remains a cornerstone of resilience. By keeping exchange rates stable and import costs predictable (critical in highly import-dependent economies), this framework contains inflation at ~2%, supports household purchasing power, and sustains demand in retail, housing, and services. Combined with fuel, food, and utility subsidies, it underpins domestic consumption and strengthens investor confidence, attracting FDI into non-oil sectors such as tourism, logistics, and technology.

However, this stability comes with trade-offs. The USD peg limits monetary policy flexibility, and subsidies impose long-term fiscal burdens. Sustainable growth will require gradual subsidy rationalization and deeper private-sector development. In contrast, non-GCC states like Lebanon and Iraq face high debt-to-GDP ratios, weak tax bases, and limited financing access, leaving them vulnerable to currency depreciation, sanctions, and double-digit inflation.

Oil Dependence and the Energy Transition

Hydrocarbons remain the backbone of fiscal revenues and exports. While OPEC+ output cuts constrained growth in 2023–2024, gradual easing in 2025 is supporting recovery and expanding fiscal space for exporters. However, the global shift toward decarbonization poses a long-term risk to oil demand, making diversification urgent to protect fiscal sustainability.

Economic Diversification and Mega Projects

GCC-led diversification efforts are accelerating in tourism, renewable energy, AI, logistics, and finance. Initiatives like Saudi Vision 2030 and the UAE's green energy programs are driving non-oil GDP. Mega projects such as NEOM and large-scale real estate and tourism hubs in the UAE continue to stimulate construction, job creation, and ancillary industries.

Shifting Trade and Investment Links

Deeper trade partnerships with China, India, and other Asian economies are reshaping export markets and investment flows, reducing reliance on the West and reinforcing energy and infrastructure collaborations.

Non-Oil Sector Expansion

Tourism, fintech, renewable energy, and logistics hubs are emerging as critical growth engines, providing buffers against oil price fluctuations and supporting employment.

Reform Progress in Select Economies

Egypt, under IMF-backed reforms, and Iraq are gradually improving fiscal and monetary frameworks, laying the groundwork for stability and investment confidence.

Persistent Challenges

Geopolitical instability - conflicts in Gaza, Lebanon, and tensions in the Persian Gulf—continues to deter investment and disrupt trade, including Red Sea shipping. Youth unemployment, exceeding 20–25% in some non-

GCC economies, alongside skill mismatches, threatens social stability. Global trade tensions, tariffs, and monetary tightening could dampen exports and capital inflows, exposing the region to external shocks.

Beyond 2025, the IMF projects regional growth of ~3.1% by 2026, contingent on reform momentum, diversification, and geopolitical stability. Risks remain high from oil price volatility, fiscal fragility in non-GCC economies, and unresolved conflicts. Sustained progress will depend on advancing structural reforms in labor markets, governance, and private-sector development to secure durable and inclusive growth.

Emerging Technologies as a Catalyst

In the Middle East, emerging technologies particularly edge computing, IoT, and blockchain are becoming central to economic diversification strategies, digital transformation agendas, and corporate investment priorities. Regional governments, especially in the GCC, are embedding these technologies into their national visions (e.g., Saudi Vision 2030, UAE's Digital Government Strategy) to reduce reliance on hydrocarbons, enhance competitiveness, and foster knowledge-based economies.

Edge computing is enabling real-time processing for mission-critical applications in sectors like energy, manufacturing, logistics, and smart cities. Oil and gas companies are deploying edge solutions for predictive maintenance, safety monitoring, and operational optimization in remote locations, reducing downtime and costs. Smart city projects, such as NEOM in Saudi Arabia and Dubai's Smart City initiatives, are integrating edge infrastructure to support autonomous transport, intelligent utilities, and AI-driven urban services.

IoT adoption is accelerating across industrial, commercial, and consumer markets. Utilities are rolling out smart grids and metering to optimize energy use and integrate renewables. Logistics hubs in Jebel Ali and King Abdullah Port are deploying IoT-enabled tracking and automation for supply chain efficiency. In healthcare, connected devices support remote monitoring, telemedicine, and hospital asset management. Retailers are using IoT to personalize customer engagement and optimize inventory management.

Blockchain is expanding beyond cryptocurrency into secure supply chain verification, trade finance, and government services. The UAE's Blockchain Strategy aims to migrate 50% of government transactions to blockchain by 2030, enhancing transparency and efficiency. Bahrain and Saudi Arabia are piloting blockchain in cross-border payments, while logistics players in Dubai are using it for shipment authentication and customs clearance. In food security, blockchain-based traceability systems are improving trust in imports and local production.

Digital services are also benefiting from the rise of cloud computing, AI, and cybersecurity—often in combination with edge, IoT, and blockchain deployments. Enterprises are modernizing IT architectures to support distributed workforces, omnichannel commerce, and data-driven decision-making. Sovereign wealth funds and private investors are channeling capital into local tech start-ups, fintechs, and smart infrastructure ventures, strengthening the regional innovation ecosystem.

Economically, these technologies are boosting productivity, creating high-skill employment, and enabling new business models across energy, finance, tourism, and manufacturing. They also attract FDI from global tech leaders seeking to establish regional hubs, particularly in the UAE, Saudi Arabia, and Qatar. Technology-led efficiencies lower operating costs, enhance service delivery, and open export opportunities in digital products and services.

As part of broader diversification strategies, emerging technologies are helping Middle Eastern economies capture value from global megatrends—such as energy transition, e-commerce expansion, and Industry 4.0—while building resilience against oil price volatility. Their integration into public and private sector agendas is positioning the region as both a consumer and creator of advanced digital solutions, making them a cornerstone of sustainable economic growth.

1.4. APAC Macroeconomic Overview

The Asia-Pacific (APAC) region's GDP growth has experienced significant fluctuations over the past decade, shaped by global shocks, pandemic recovery, and structural transitions. Growth slowed from 5.7% in 2017 to 4.3% in 2019 amid trade tensions and moderating demand, before contracting by –0.8% in 2020 due to COVID-

19 disruptions. A strong rebound followed in 2021 (7.2%), supported by stimulus measures and reopening, but growth normalized to 4.3% in 2022 as fiscal support waned and global conditions tightened. In 2023, growth improved to 5.1%, led by resilient domestic demand in emerging markets and robust recovery in India and ASEAN, but slowed to 4.5% in 2024 as external headwinds, weak global trade, and China's property sector woes weighed on momentum.

Exhibit 17: APAC GDP Growth Rates (%), 2017-2026
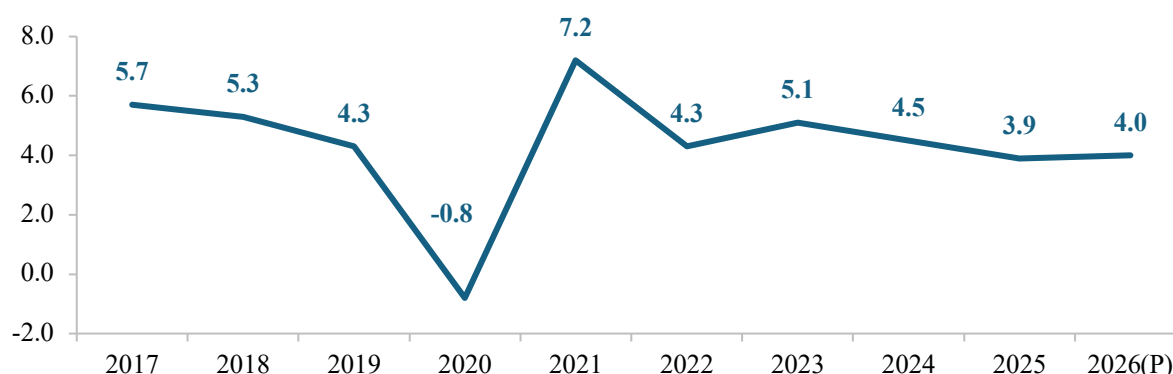
Source: IMF, World Bank
P-Projection

In 2025, growth is projected to moderate further to 3.9%, reflecting weaker export performance amid tariff risks, a slowing tech cycle affecting economies like South Korea and Taiwan, and subdued recovery in China. However, resilient domestic consumption, infrastructure-driven investment in India and ASEAN, and policy easing across several economies provide some offset. Structural drivers such as digital transformation, supply chain diversification, and green transition initiatives are also expected to underpin medium-term growth. Looking ahead, the IMF forecasts a slight recovery to 4.0% in 2026, contingent on stabilization in China, easing trade frictions, and continued policy support. Overall, while APAC remains the world's fastest-growing region, its 2025 outlook signals a shift toward slower but more balanced growth, driven increasingly by domestic demand, technology adoption, and regional integration rather than export-led momentum.

1.4.1. Key trends, drivers and challenges shaping Asia Pacific (APAC) Macroeconomics

Asia Pacific's GDP growth is projected to slow to 3.9% in 2025 from 4.5% in 2024, reflecting weaker global trade, China's subdued recovery, and softer technology demand. Export-dependent economies such as South Korea, Taiwan, and Singapore face reduced manufacturing output, dampened trade volumes, and weaker fiscal revenues, limiting public investment.

China's structural slowdown - Driven by a prolonged property slump, aging demographics, and slower investment—continues to weigh on regional supply chains, commodity exports, and tourism. This also erodes investor confidence in regional equity and currency markets, depressing trade-linked revenues.

India and ASEAN are emerging as growth anchors, with India's 6.4–6.5% expansion and ASEAN's young demographics and trade integration bolstering domestic demand. These markets create new intra-regional investment opportunities that partly offset China's weakness.

Technology, the green transition, and the digital economy are increasingly central to APAC's growth. Expanding e-commerce, fintech, AI services, and cloud computing improve financial inclusion, SME competitiveness, and job creation. Investments in AI, EVs, semiconductors, renewables, and Industry 4.0 are driving high-value industries and attracting FDI, especially in Singapore, Taiwan, South Korea, and India. Adoption of IoT and blockchain further boosts efficiency, supply chain transparency, and competitiveness, though realizing full benefits will require regulatory harmonization, strong cybersecurity, and talent development.

Public infrastructure investment including India's Gati Shakti and Indonesia's Nusantara capital project is modernizing transport, logistics, and energy networks, reducing bottlenecks, and stimulating economic activity across sectors.

Trade integration via RCEP is lowering tariffs, harmonizing standards, and strengthening intra-APAC supply chains, reducing reliance on Western markets.

Domestic demand-led growth is rising in India, Indonesia, and Vietnam, improving resilience but risking inflation in food and housing if supply lags demand.

Supply chain diversification under the "China+1" strategy is boosting industrial activity and FDI in Vietnam, India, and Indonesia, though it requires significant infrastructure investment.

Geopolitical tensions including U.S.-China disputes, Taiwan Strait risks, and South China Sea disputes are disrupting investment flows and raising costs. Climate risks add fiscal pressures and accelerate the need for costly green infrastructure.

APAC's 2025 growth will rely on domestic demand, infrastructure investment, and tech-led transformation to counter headwinds from China's slowdown, trade tensions, and climate risks. Success will depend on leveraging demographics, advancing green transition, and strengthening regional integration.

1.4.2. Emerging Technologies and Digital Services in APAC: Growth, Impact, and Diversification

Emerging technologies particularly edge computing, IoT, and blockchain are becoming integral to business strategies and government agendas across Asia Pacific (APAC), driving productivity, innovation, and economic diversification. Rapid urbanization, expanding digital infrastructure, and strong government support are accelerating adoption, making these technologies central to the region's post-pandemic transformation.

Edge Computing is enabling real-time data processing in industries, reducing latency and enhancing AI-driven decision-making. In industrial hubs like Japan, South Korea, and Singapore, edge solutions are powering predictive maintenance, autonomous systems, and smart city infrastructure. For large-scale manufacturing in China, Vietnam, and India, edge integration is improving operational efficiency and reducing downtime, directly impacting competitiveness.

IoT adoption is growing rapidly, with applications in smart factories, connected vehicles, precision agriculture, retail analytics, and urban mobility. Industrial IoT is strengthening supply chain visibility and enabling predictive asset management, while consumer IoT is enhancing lifestyle services, home automation, and wearable technology markets. Countries like India and Indonesia are using IoT-enabled smart metering and energy management to improve sustainability and efficiency in utilities.

Blockchain is extending beyond cryptocurrency into trade finance, supply chain authentication, cross-border payments, and public sector services. In Singapore and Hong Kong, blockchain-based trade platforms are reducing transaction times and enhancing security. Australia and New Zealand are exploring blockchain for food traceability, boosting export credibility. Financial hubs across APAC are piloting central bank digital currencies (CBDCs) to modernize payments infrastructure.

Digital Services and the Cloud are expanding rapidly. Cloud migration, AI-powered analytics, and platform-based business models are improving scalability and enabling SMEs to compete in global markets. E-commerce, fintech, and digital payments ecosystems are growing rapidly in Southeast Asia, contributing significantly to GDP and fostering financial inclusion.

These technologies are reshaping economic growth by:

- Diversifying GDP beyond traditional manufacturing and commodities toward high-value digital and service sectors.
- Attracting FDI from global technology leaders establishing R&D hubs, data centers, and innovation labs in APAC.
- Creating high-skilled jobs in data science, cybersecurity, software development, and systems integration.

- Boosting competitiveness by improving productivity, reducing costs, and enabling new revenue streams.

Governments are integrating these technologies into national strategies such as South Korea's Digital New Deal, Singapore's Smart Nation initiative, and India's Digital India program—aligning policy, infrastructure investment, and workforce development to capture long-term benefits.

Edge computing, IoT, blockchain, and broader digital services are no longer peripheral in APAC, they are at the core of economic strategy and corporate investment. By enhancing efficiency, transparency, and innovation, they are driving business transformation, powering new industries, and becoming key pillars of the region's economic diversification and resilience in an increasingly digital global economy.

GLOBAL DIGITAL TRANSFORMATION

1.5.   Global Digital Transformation Landscape – Overview

In a world where digital technology permeates every facet of our lives, it's no surprise that businesses and organizations are racing to keep up with the ever-evolving landscape of digital transformation. Digital transformation is not just a trend; it's a paradigm shift that has fundamentally altered the way we conduct business, manage resources, interact with customers, and innovate in the current technology landscape.

In the relentless march of progress, digital transformation stands out as one of the defining forces reshaping the technology and business landscape. As the digital era is unfolding, this profound shift is promising to change the way we are working, interacting, and doing business in fundamental ways.

The Changing Technology Landscape

Digital transformation also profoundly affects the technology landscape, ushering in new possibilities and trends such as:

Emergence of AI and Machine Learning: AI and machine learning have become central to digital transformation. These technologies power automation, predictive analytics, and personalization, enhancing both internal processes and customer-facing interactions.

Advanced Analytics: Advanced analytics is revolutionizing the technology landscape, enabling organizations to derive deeper insights from vast amounts of data. By employing techniques like machine learning, predictive modeling, and statistical analysis, businesses are transforming decision-making processes, leading to more informed, data-driven strategies. This shift is integral to the global digital transformation, as it allows companies to harness the full potential of their data assets, improving efficiency and innovation.

Internet of Things: The proliferation of IoT devices is creating vast streams of data that can be harnessed for insights and automation. IoT is connecting everything, from smart homes and factories to healthcare devices, reshaping various industries.

Edge Computing: Edge computing is transforming digital transformation by processing data closer to its source, reducing latency, enhancing real-time decision-making, and improving reliability. It powers smart manufacturing, autonomous systems, and IoT applications, enabling businesses globally to boost efficiency, optimize operations, and deliver faster, more personalized digital services to end-users.

Blockchain: Blockchain is revolutionizing digital transformation by providing secure, transparent, and tamper-proof data sharing across decentralized networks. From supply chain tracking to digital identity verification and cross-border payments, it enhances trust, reduces fraud, and streamlines processes, empowering industries worldwide to innovate and collaborate without reliance on centralized intermediaries.

Cloud Computing: Cloud services provide scalable, cost-effective solutions for businesses. The flexibility and accessibility of cloud computing are integral to digital transformation, enabling remote work, data storage, and collaboration.

Cybersecurity: As digital reliance grows, so does the need for robust cybersecurity. Protecting sensitive data and ensuring secure digital operations are paramount. cybersecurity is an integral part of digital transformation initiatives.

Industry Matter Expertise & Business Transformation: The convergence of industry matter expertise and business transformation is pivotal in today's technology landscape. This integration facilitates the creation of tailored solutions that address specific industry challenges, leading to more effective digital transformation strategies.

Business Process Services: Business Process Services ("BPS") are at the forefront of reshaping the technological landscape. By integrating advanced technologies like AI and machine learning into traditional business processes, BPS providers are enabling organizations to streamline operations, reduce costs, and enhance customer

experiences. This evolution is essential for businesses seeking to adapt and thrive in the digitally transformed world, where operational agility and efficiency are key to success.

Robotic Process Automation: RPA is a transformative force in the realm of digital technology. By automating repetitive, rule-based tasks, RPA tools are freeing up human resources for more strategic, creative work. This shift is not only improving operational efficiencies but also driving innovation, as employees are able to focus on higher-value activities. RPA's role in digital transformation is crucial, as it represents a significant step towards more intelligent, automated business processes.

Hyperautomation: Hyperautomation orchestrates a diverse array of technologies and tools, including AI, ML, event-drive architecture, RPA, Intelligent Business Process Management Suites ("iBPMS"), Integration platform as a Service ("iPaaS"), and low-code / no-code tools. This great leap forward propels businesses towards greater efficiency and agility. Hyperautomation is a key factor in the digital transformation as it eliminates human involvement in low-value processes.

DevOps: DevOps is reshaping the technology landscape by bridging the gap between software development and IT operations. This practice emphasizes collaboration, continuous integration, and rapid deployment, leading to faster and more efficient software development cycles. In the context of global digital transformation, DevOps is critical, as it enables organizations to quickly adapt to changing market demands, roll out new features seamlessly, and maintain a competitive edge in a rapidly evolving digital world.

Design Thinking: Digital transformation enhances the capabilities of design thinking by providing new tools, data, and methodologies. It empowers designers to create more user-centric, innovative, and responsive solutions in an environment where technology and human-centered design are increasingly interconnected. Technology's impact on Design Thinking includes advanced digital tools, VR and AR technologies, AI-driven insights, collaboration platforms, user-centered design software, 3D printing, big data analytics, and IoT technologies. These advancements revolutionize the Design Thinking process, reinforcing its central role in the future of design and innovation.

Customer Experience: In the changing technological landscape, customer experience is being significantly impacted by digital transformation. Organizations across industries are leveraging advanced technologies, such as AI, IoT, and cloud computing, to enhance customer experience and drive business success. Digital transformation is shifting organizations towards a customer-centric approach, enhancing personalization and convenience. Leveraging data-driven insights improves customer experience, fostering loyalty, satisfaction, and business performance.

1.5.1.   Defining Digital Transformation for The Evolving Enterprise Requirements

As enterprises navigate through shifting market landscapes and respond to evolving consumer demands, understanding the essence of digital transformation within this context becomes crucial. At its essence, digital transformation involves strategically integrating digital technologies to elevate business operations, spur innovation, and enhance experiences for both customers and employees. It's a comprehensive transformation, not only in terms of technology adoption, but in redefining how enterprises function, communicate, and deliver value.

The evolution of modern enterprises is a testament to the transformative power of digital transformation. The transition from traditional, hierarchical structures to agile, customer-centric organizations underscores the impact of digital transformation. Modern enterprises prioritize flexibility, data utilization, remote work support, and robust bersecurity, reflecting their responsiveness to evolving customer expectations and market dynamics. Technology, from cloud computing to AI, IoT, and 5G connectivity, plays a pivotal role in driving these changes, enabling modern enterprises to navigate a dynamic, data-centric, and agile business landscape successfully.

For the evolving enterprise, digital transformation can unlock unparalleled growth opportunities across the following:

Business Model Innovation

Digital transformation challenges traditional business models. It encourages modern enterprises to rethink how they create, deliver, and capture value. Through innovative digital strategies, companies can diversify revenue

streams, expand their market reach, and explore new lines of business. This innovative shift is particularly evident in industries where digital disruption has become the norm, such as e-commerce, streaming services, and fintech. By embracing digital transformation, enterprises position themselves to be agile and adaptable, ready to pivot when market conditions demand it.

Competitive Differentiation

In an era defined by relentless competition, digital transformation provides a means for modern enterprises to stand out. By leveraging technology and data-driven insights, companies can differentiate themselves through superior customer experiences, product innovation, and efficient operations. The ability to swiftly adapt to changing market dynamics and customer needs gives modern enterprises a competitive edge. This differentiation translates into higher customer retention, market share growth, and enhanced brand reputation.

Micro-Innovation Approach

Micro-Innovation entails continuous, minor enhancements using digital technologies. These nuanced, progressive enhancements, as opposed to large-scale disruptions can significantly enhance efficiency, customer experience, and overall value over time. A collaborative effort involving numerous micro-innovations to support and enhance innovation within an organization will foster an agile ecosystem that rapidly adapts to technological advancements and market shifts.

Product / Platform Engineering Mindset

In digital transformation, the product/platform engineering mindset centers on a user-centric approach, applying product management principles to treat the platform as a product. It emphasizes user needs, incorporates AI and automation, and necessitates user research, feedback loops, and internal marketing. Treating developers as customers, the mindset focuses on reducing friction, enhancing value, and evolving continuously for improved user experience, emphasizing the importance of internal customer interactions.

Scalability and Flexibility

Digital transformation empowers modern enterprises with scalability and flexibility that were previously challenging to achieve. Cloud computing and virtualization technologies allow businesses to scale their operations up or down based on demand. This flexibility minimizes the need for large, upfront investments in physical infrastructure and enables a "pay-as-you-go" model. It also provides the freedom to explore new markets and experiment with different business strategies without the limitations of traditional brick-and-mortar constraints.

Global Reach and Market Expansion

The digital transformation journey extends beyond local markets and opens doors to global opportunities. By leveraging e-commerce platforms, online marketplaces, and digital advertising, modern enterprises can access a global customer base. This expansion comes with its unique challenges, such as international regulations and logistics, but it also unlocks immense growth potential. The modern enterprise is no longer confined to regional limitations but can explore new territories and markets with a global perspective.

Enhanced Decision-Making

Data analytics and artificial intelligence play pivotal roles in enhancing decision-making within the evolving enterprise. Through digital transformation, businesses can access vast amounts of data, analyse it in real-time, and derive actionable insights. This data-driven decision-making enables companies to make informed choices, respond swiftly to market changes, and innovate more effectively. It is no longer a matter of intuition but rather a science driven by data and analytics.

1.5.2.   Need for Digital Transformation in Today's Scenario

The business landscape of today is undergoing an unprecedented transformation, driven by the convergence of rapidly advancing technologies, changing customer expectations, and recent global events. In this context, the need for digital transformation has become more than a strategic choice—it has evolved into a survival imperative for organizations in every sector. Customers, both individuals and enterprises, expect seamless and personalized experiences, which necessitate a fundamental shift in how organizations operate and deliver value. Additionally,

the COVID-19 pandemic highlighted the critical importance of resilience, agility, and the ability to function in remote and distributed environments.

These factors underscore the first crucial need for digital transformation: Adaptation to the digital age. Organizations must embrace digital technologies to stay competitive, agile, and responsive to a rapidly evolving marketplace. In today's scenario, the failure to adapt means risking obsolescence. As businesses that are slow to change struggle to meet customer expectations, disruptive newcomers emerge with innovative digital solutions that challenge established players.

The second essential need for digital transformation lies in data utilization and insights. Data is the new currency, and organizations must harness its potential for informed decision-making, personalization, and competitive advantage. Data-driven strategies enable organizations to understand customer behaviour, anticipate market trends, and respond proactively. Digital transformation empowers businesses to not only collect and store vast amounts of data but also extract valuable insights through advanced analytics.

Digital transformation also addresses the need for enhanced operational efficiency. By automating processes, optimizing workflows, and reducing manual tasks, organizations can significantly improve productivity and reduce operational costs. Moreover, flexible work environments are imperative in today's scenario. The traditional office-centric model has given way to remote and distributed workforces. Digital transformation equips businesses with the tools and infrastructure to enable effective remote work, supporting flexibility and continuity in a post-COVID-19 world.

Cybersecurity and compliance represent another critical need. The increasing reliance on digital technologies has expanded the attack surface for cyber threats. Protecting sensitive data and ensuring compliance with evolving regulations are non-negotiable. Businesses must invest in robust security measures to safeguard their operations and build trust with customers.

Emerging technologies such as AI, edge computing, IoT, and blockchain are becoming pivotal enablers of digital transformation. Together, these technologies enhance agility, unlock new business models, and create resilient, data-driven ecosystems, positioning organizations to not only adapt but thrive in the digital-first economy.

1.5.3. Drivers and Constraints for Digital Transformation Adoption

Market Drivers:

Many businesses are prioritizing digital transformation, but it's crucial to understand the variables that are necessitating this shift. The following are some of the key drivers which propel the adoption of digital transformation.

Exhibit 18: Market Drivers for Digital Transformation Adoption
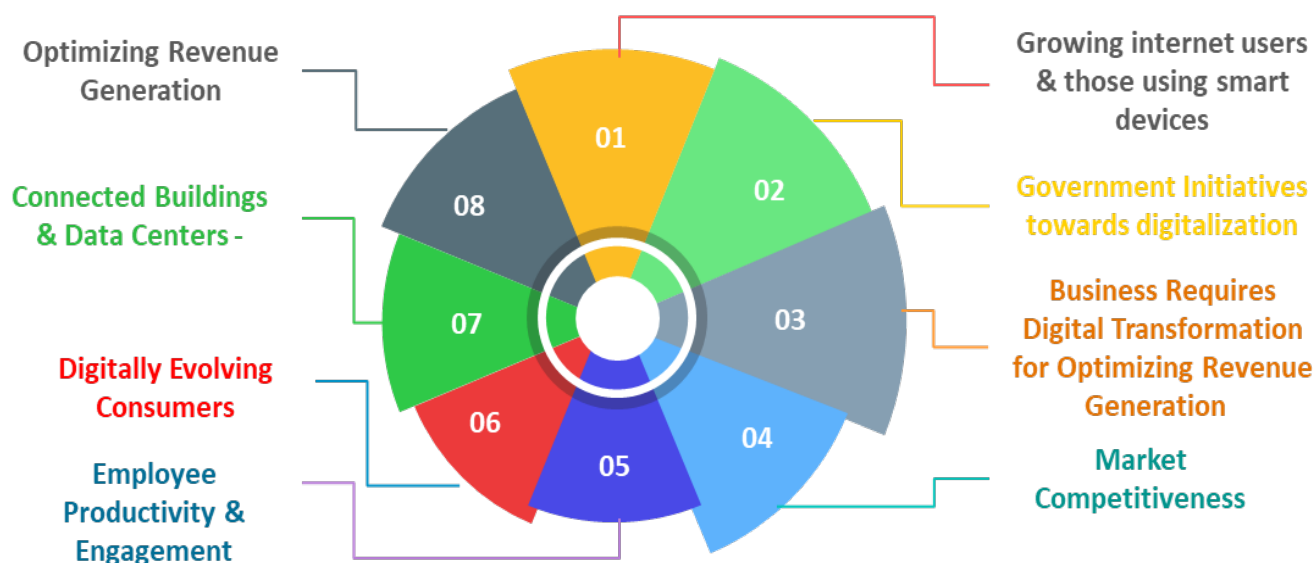
1. Growing internet users / and those using smart devices

As per datareportal, as of early 2025, nearly 67.9% of the world's population is online. This means a massive and growing pool of people are actively using the internet for communication, information, and various digital services. Growing internet users and the widespread adoption of smart devices are catalysing digital transformation by creating a connected ecosystem where individuals and businesses interact seamlessly. As per datareportal, as of January 2025, there were 5.56 billion internet users worldwide more than double of 2.73 billion users in January, 2014. Internet is omnipresent and has penetrated like no other technology with almost 67.9% of global population using it today up from 46.9% in Jan 2017 Internet enjoys a penetration of over 93% in USA. With more people accessing the internet and utilizing smart devices, there's an increasing demand for digital solutions that offer convenience, accessibility, and efficiency.

Exhibit 19: Global Internet Users (2017-2025), in Billions
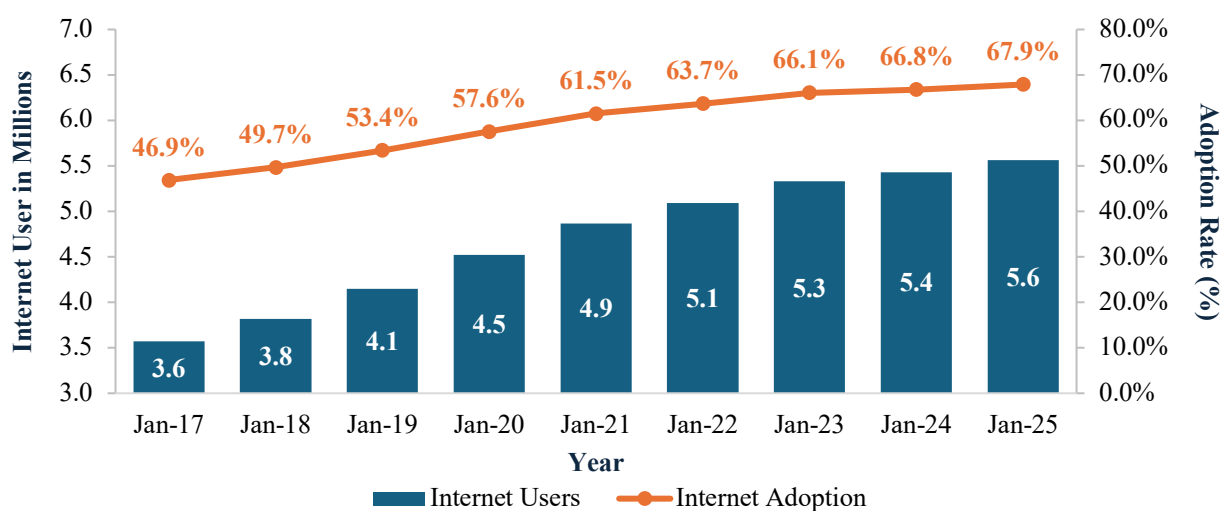
Source: Datareportal

As per datareportal, almost 96.3% (as on Feb, 2025) of the global digital population uses mobile devices to access the internet. According to Ericsson, the number of smartphones in the world today in 2024 is 7.21 billion. This figure is a considerable 29% increase from five years ago when it was estimated that there were 5.59 billion smartphones globally. About 60.42% of the world's population owns a smartphone in 2024.

Exhibit 20: Increasing number of Smartphones and Smartphone Users (Bn), Global, (2014 – 2030)
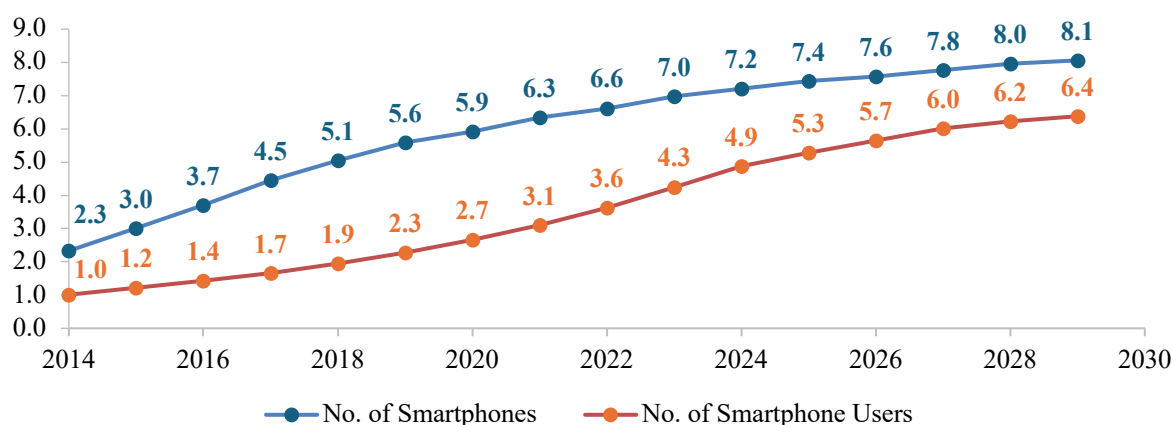
Source: Ericsson Mobility Report, Frost & Sullivan analysis

This mobility creates a constant state of connection, further pushing the need for businesses and organizations to have a digital presence. This trend further pushes organizations to innovate and digitize their operations to meet evolving consumer needs and preferences. Furthermore, the accessibility of information and services online

encourages businesses to leverage digital platforms for marketing, communication, and sales, thereby driving the transformation towards a more digitally oriented economy.

1.6. Government Initiatives towards digitalization

Government initiatives towards digitalization are propelling digital transformation by setting the stage for widespread adoption of digital technologies and practices. According to Mckinsey, digitization has the potential to unlock over $3.5 trillion of economic value for governments. Streamlining processes through digital tools saves time, reduces paperwork, and minimizes errors, leading to significant cost reductions. Through policies, incentives, and investments, governments aim to modernize infrastructure, improve service delivery, and enhance citizen engagement. Listed below are initiatives that governments globally could take to empower citizens:

- Digital identity program: Governmental bodies are on the verge of offering mobile-centric identity wallets to citizens, thereby promoting trust and innovation within digital identity frameworks. Pioneering initiatives such as DigiLocker and Aadhaar in India stand as initial models of this impactful shift.
- e-government services: Governments worldwide are increasingly prioritizing the delivery of digital services. There is a global push to integrate digital services with cloud communications to enhance citizen experience and boost staff productivity.
- Introduction of data sharing platforms: Anticipated is the establishment of formal frameworks by governments for data sharing, with a focus on achieving value-added outcomes and mission objectives. Such frameworks are poised to improve transparency and accountability in data sharing initiatives, thereby facilitating effective decision-making across departments.

Regulations promoting data protection and cybersecurity instill trust in digital transactions, further accelerating the transition. By prioritizing digitalization, governments not only drive economic growth and efficiency but also empower citizens and businesses to thrive in an increasingly digital world.

3. Business Requires Digital Transformation for Optimizing Revenue Generation

Businesses are empowered by digital transformation to investigate new markets and sources of income. Organisations can reach a wider audience by leveraging digital marketing, e-commerce, and online platforms. Data insights can be gathered, analysed, and used in real time with the help of digital transformation. In addition to increasing competitiveness, this data-driven decision-making helps predict consumer preferences and market trends, which helps with efficient revenue generation.

4. Market Competitiveness

Businesses are leveraging digital transformation to enhance competitiveness through various means. They're adopting advanced analytics to gain insights into customer behaviour and market trends, enabling them to make data-driven decisions quickly. Embracing cloud computing allows for scalability and flexibility in operations, reducing costs and increasing efficiency. Moreover, automation streamlines processes, minimizing errors and accelerating workflows. Integration of emerging technologies like artificial intelligence and IoT optimizes production and enhances product quality. Enhanced digital marketing strategies, including social media and personalized advertising, help businesses reach and engage with their target audiences more effectively. Overall, embracing digital transformation enables businesses to stay agile, innovative, and responsive to market demands, ultimately driving competitiveness.

5. Employee Productivity and Engagement

Modern employees expect digital tools that facilitate remote work, collaboration, and seamless communication. Digital transformation enhances productivity and engagement by providing the tools and flexibility needed for the workforce. Engaged employees are more motivated and contribute to the organization's success.

6. Digitally Evolving Consumers

Customers' demands are always changing. The emphasis on speed is the most apparent advancement as technology advances. Customers anticipate having their wants answered instantly as communication becomes more rapid and

simple. It is in a company's best interests to implement the technology required for quick connection with customers because the customer experience is a crucial component of corporate success.

7. Connected Buildings and Data Centers - Pivotal in driving digital transformation

Connected buildings and data centers are pivotal in driving digital transformation by enabling seamless integration of IoT devices, sensors, and smart systems. These interconnected infrastructures gather vast amounts of data, which is then analysed to optimize building operations, enhance energy efficiency, and improve occupant comfort. Additionally, data centers provide the necessary computational power and storage capacity for processing and storing this data securely. Investments by technology companies are propelling the growth of the global data center market, particularly in North America where there is a strong emphasis on hyperscale data centers and cloud infrastructure. As per Frost & Sullivan estimates, the data centre investment is forecasted to grow from $231 billion in 2020 to $583.8 billion in 2030 at a compound annual growth rate of 10% driven by the proliferation of data usage and investments. Nvidia CEO Jensen Huang predicts that within the next four to five years, the world will witness the construction of data center infrastructure and hardware worth a trillion dollars.

By leveraging connected building technologies and data centers, organizations can streamline operations, reduce costs, and innovate new services, thus accelerating their digital transformation journey.

8. Optimizing Revenue Generation

Digital transformation enables businesses to explore untapped markets and revenue streams. By leveraging online platforms, digital marketing, and e-commerce, organizations can expand their reach beyond traditional boundaries. Digital transformation allows businesses to collect, analyse, and act on data insights in real time. This data-driven decision-making not only enhances competitiveness but also helps in anticipating market trends and customer preferences, and thereby contributing to effective revenue generation.

Market Constraints:

Exhibit 21: Market Constraints for Digital Transformation Adoption

1. Cost and Resource Constraints

Small and mid-sized businesses may struggle to allocate the necessary funds and the required human resource for a comprehensive transformation. The adoption of the technology might be diminished for SMEs, as their operations often involve smaller scales and less intricate processes. The perceived lower complexity may lead to a cautious approach to adoption, as the costs may not align with the scale of their business operations.

2. Lack of Digital Skills

The shortage of digital skills in the workforce is a significant restraint. Organizations may struggle to find and retain talent with the necessary expertise in areas like data analytics, AI, and cybersecurity. Training and upskilling programs are essential to bridge this skills gap.

3. Change Resistance

Employees may resist digital transformation due to fear of job displacement, unfamiliar technology, or concerns about job security. Change management becomes crucial in overcoming this restraint. Effective communication, training, and involvement in the transformation process can also mitigate resistance.

4. Unclear ROI

Some organizations struggle to define and measure the return on investment (ROI) for digital transformation initiatives. The lack of clear metrics and a tangible business case can deter adoption. Developing a robust ROI framework and continuously evaluating progress can help address this restraint.

5. Complexity and Integration Challenges

Digital transformation often involves complex integration of various technologies and platforms. Overcoming integration challenges, ensuring data consistency, and upholding system reliability can present formidable challenges. A well-defined integration strategy and ongoing monitoring are crucial to address this restraint.

1.6.1. Global Spending on Digital Transformation

The market for digital transformation has experienced exponential growth, driven by a convergence of factors. Increasing competitive pressures have compelled organizations to invest in digital technologies to gain a competitive edge. Simultaneously, changing customer expectations have placed a premium on personalized, data-driven experiences, necessitating digital transformation initiatives.

Moreover, the COVID-19 pandemic served as a catalyst, accelerating the adoption of digital technologies to enable remote work, enhance supply chain resilience, and facilitate online customer interactions. As a result, digital transformation is expected to grow at a CAGR of 13.3% (2025 to 2030), underscoring its indispensable role in the modern business landscape. This growth trend is expected to continue as businesses recognize that digital transformation is not merely an option but an imperative for future success. Digital transformation serves as a catalyst for modernizing businesses, leading to enhanced efficiencies, heightened profitability, and an improved customer experience. Digital transformation contributes to boosting Return on Equity (ROE) through strategic levers such as sustainable cost reduction and a focus on customer-centric approaches. While the effects on profitability may require time for integration and validation, a thorough analysis underscores its potential to enhance enterprise performance in the long run. The United States continues to account for more than 35% of worldwide DX spending.

Exhibit 22: Spend on Digital Transformation Globally & in USA, 2020 to 2030, USD billion

Year	USA	Global
2030	2,003	5,565
2029	1,791	4,974
2028	1,590	4,417
2027	1,396	3,878
2026	1,216	3,386
2025	1,069	2,978
2024	890	2,480
2023	695	1,940
2022	595	1,661
2021	511	1,428
2020	421	1,176

■ USA ■ Global
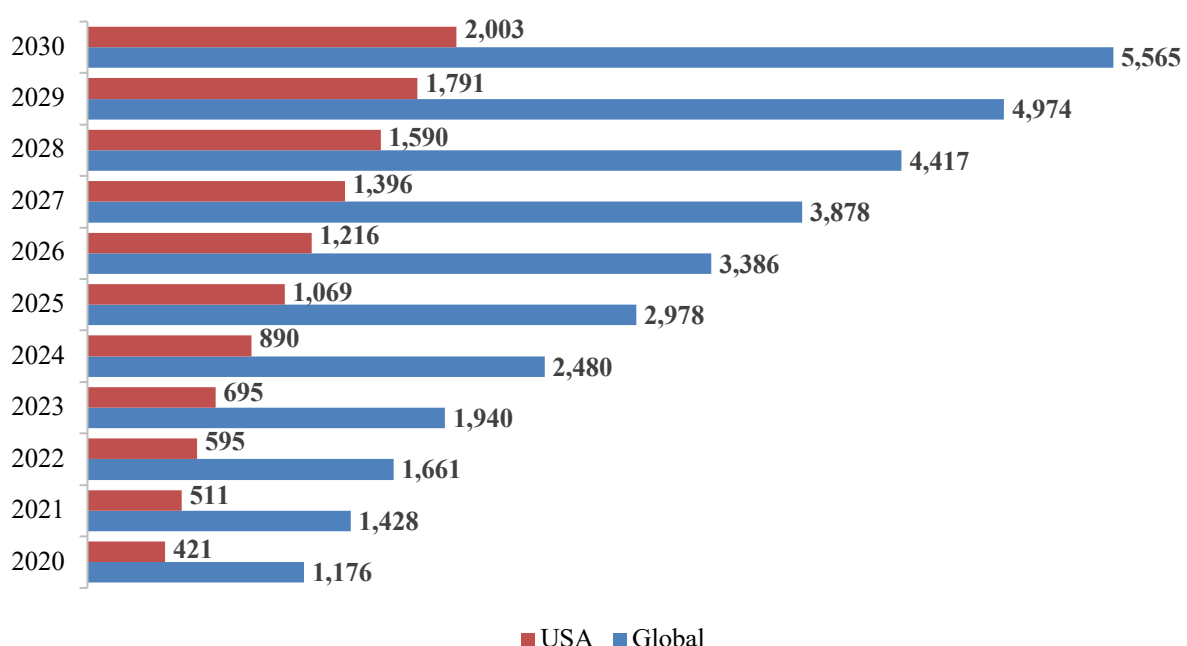
Spend on Digital Transformation - USA

The United States stands at the forefront of digital transformation, with substantial investments pouring into digital initiatives across various industries. It is projected that the US digital transformation market would reach USD 2,003 Billion in 2030. The pandemic drove a surge in digital transformation investments across various sectors. Companies rapidly shifted to remote work arrangements, leading to increased spending on cloud computing, collaboration tools, and cybersecurity solutions. The healthcare sector in the US also witnessed significant digital transformation efforts, with telemedicine services experiencing unprecedented growth.

The US is heavily investing in digital transformation across multiple sectors. In connected buildings, funds are directed towards IoT technologies, smart sensors, and energy-efficient systems to optimize operations, improve sustainability, and enhance occupant comfort. Data Center investments focus on expanding capacity, improving resilience, and adopting advanced cooling and power management technologies to support the growing demand for digital services. The US is investing significantly in AI-enabled digital transformation across sectors, driven by government initiatives, industry adoption, research and development, startups, and workforce development. This investment aims to foster innovation, competitiveness, and economic growth by leveraging AI technologies to enhance operations, improve decision-making, and deliver personalized experiences to customers. Overall, the USA is committed to harnessing AI's transformative potential to maintain leadership in the global AI landscape and drive progress in the digital economy.

1.6.2.   The Need and Significance of Emerging Technologies in Revolutionizing Digital Transformation Globally

In the rapidly evolving digital economy, the combined force of emerging technologies like edge computing, Internet of Things (IoT), and blockchain is revolutionizing how businesses, governments, and societies operate. As organizations navigate an increasingly complex landscape marked by massive data volumes, heightened customer expectations, and growing cybersecurity threats, these technologies have emerged as essential enablers of global digital transformation.

Edge computing addresses one of the most pressing needs in modern digital ecosystems: speed. Traditional cloud models often struggle with latency when real-time decisions are critical, such as in autonomous vehicles, industrial automation, remote healthcare, and financial trading. By processing data closer to its source, edge computing reduces delays, improves responsiveness, and ensures operational continuity even in environments with unreliable connectivity. This capability is vital in an era where microseconds can determine competitive advantage, safety, or customer satisfaction.

IoT expands the scope of digital transformation by connecting billions of devices, ranging from consumer electronics and wearables to industrial sensors and infrastructure systems that continuously gather and transmit data. These connected ecosystems enable unprecedented visibility into operations, customer behavior, and environmental conditions. IoT fuels predictive maintenance in manufacturing, optimizes energy consumption in smart grids, enhances precision in agriculture, and personalizes experiences in retail. The value lies not just in the data collected, but in the actionable insights that drive innovation, efficiency, and new revenue streams.

Blockchain addresses the growing need for trust, transparency, and security in an interconnected world. As digital transformation accelerates, ensuring the integrity and authenticity of data has become mission-critical. Blockchain's decentralized, tamper-proof ledger makes it possible to verify transactions, track the provenance of goods, secure IoT-generated data, and execute smart contracts without intermediaries. This fosters trust among ecosystem participants, reduces fraud, and streamlines compliance to develop capabilities essential for industries like finance, supply chain, healthcare, and government.

The significance of these technologies lies in their synergistic impact. IoT generates vast amounts of real-time data; edge computing processes it instantly where it's most needed; blockchain secures and validates it, ensuring trust across networks. Together, they create resilient, transparent, and intelligent systems capable of transforming industries, from enabling smart cities and autonomous logistics to redefining digital finance and personalized healthcare.

In the context of global digital transformation, edge, IoT, and blockchain are no longer optional but are strategic imperatives. They enable organizations to operate faster, smarter, and more securely, positioning them to thrive in a competitive, data-driven world where agility, trust, and innovation determine long-term success.

GLOBAL TECHNOLOGY MARKET

1.7.   Global Technology Market Size

The Global Technology landscape continues to evolve in response to shifting workplace dynamics, digital transformation imperatives, and innovation demands. IT services, software, and Engineering Research and Development ("**ER&D**") segments are expected to see sustained growth, driven by a commitment to modernization and technology-driven solutions. The global technology market is expected to grow to a size of USD 8,581 billion by 2030 at a compound annual growth rate ("**CAGR**") of 8.3% (2025 to 2030).

Exhibit 23: Global IT Market Size (2020 to 2030), in USD billion
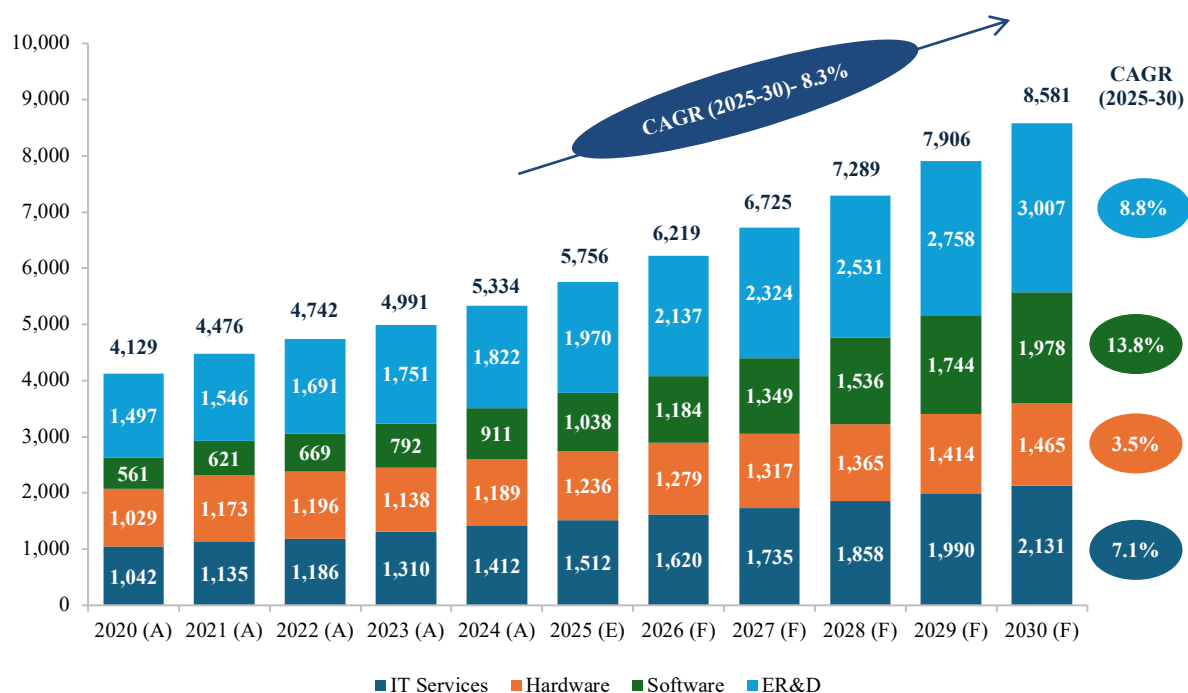
Source: Frost & Sullivan, Secondary Sources

IT Services demonstrated resilience and growth during and after the pandemic, and this trend is expected to persist. In recent years, IT services have seen significant increases, driven by investments in cloud services, which will remain a primary focus for technology leaders in the coming years. The momentum in this segment is projected to continue, with robust forecasts for the future. As businesses seek to modernize their IT infrastructure and digital platforms, there's a strong impetus to move away from legacy systems towards agile and efficient solutions.

As companies resume their paused projects, they are likely to allocate more resources towards technology investments to accelerate digital transformation initiatives, enhance operational efficiency, and remain competitive in the market. Moreover, with a higher number of deals expected across sectors, there will be greater demand for technology solutions and services to support various aspects of business operations, such as remote work infrastructure, cybersecurity, data analytics, and customer experience enhancement. This heightened activity is projected to drive robust growth in technology spend as organizations prioritize leveraging technology to drive innovation, growth, and resilience.

By 2030, IT services is anticipated to reach USD 2,131 billion in spending, reflecting a sustained commitment to digital transformation, growing at a CAGR of 7.1% (2025 to 2030).

Hardware investment held steady as remote work, telemedicine, and remote learning gained prominence. However, the hardware market's growth is expected to remain sluggish in the foreseeable future. The focus in this segment is shifting towards enterprise devices that need upgrades or investments to support hybrid work settings.

The hardware market is likely to experience subdued growth as large-scale investments in certain areas may not be as necessary. This segment's performance underscores the changing landscape of workplace technology needs. The segment is expected to grow at a CAGR of 3.5% (2025 to 2030).

Software witnessed significant growth during and after the pandemic, driven by enterprises prioritizing infrastructure software expenses to support their digital transformation efforts. This trend is expected to persist as organizations continue their digital journeys. Investments in software are projected to remain robust, with enterprises aiming to enhance their digital capabilities and streamline operations. By 2027, software spending is estimated to reach USD 1,978 billion, reflecting ongoing investments in software solutions to drive efficiency and innovation, growing at a CAGR of 13.8% (2025 to 2030).

ER&D, a critical driver of innovation, is poised for sustained growth. In recent years, ER&D investments have been instrumental in technological advancements across industries. As businesses strive to stay competitive and bring innovative products and services to market, ER&D spending is anticipated to rise steadily. The growing demand for breakthrough technologies, product innovation, and digital transformation will fuel the expansion of ER&D investments. By 2027, ER&D spending is projected to reach USD 3,007 billion, highlighting its pivotal role in shaping the future of technology.

Besides, emerging technologies and digital services like edge computing, IoT, and blockchain etc. are driving global technology spending, as organizations invest to meet growing demands for speed, connectivity, and trust. These technologies unlock innovation, improve competitiveness, and support the development of next-generation services. Their integration is compelling businesses and governments worldwide to allocate greater budgets towards infrastructure, cybersecurity, and digital transformation initiatives.

1.7.1. Global Technology Spend Across Key Technologies

Exhibit 24: Global IT Spend Across Key Technologies (2020 to 2030), in USD Billion
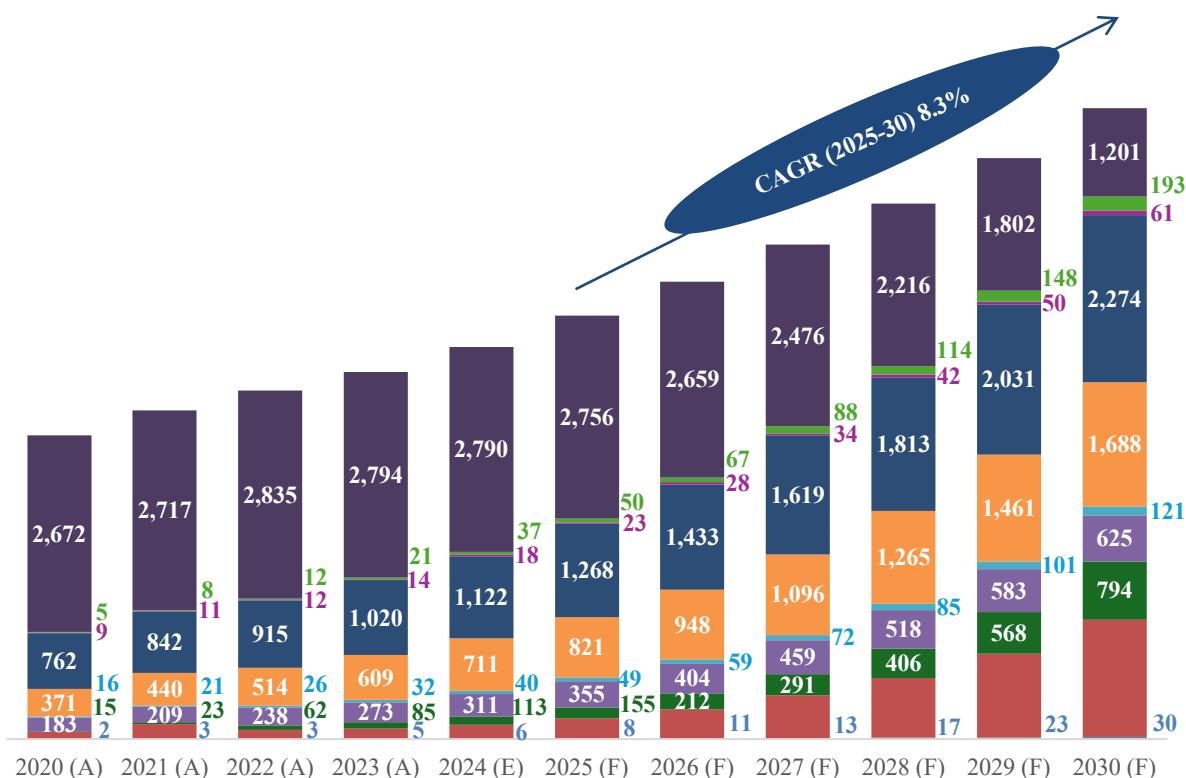
Source: Frost & Sullivan, Secondary Sources

The global IT spend across select key technologies is experiencing substantial growth, with a projected total spend of USD 7,381 billion by 2030 (excluding Others), driven by a compelling CAGR of 20% (2025 to 2030).

Robotic Process Automation ("**RPA**") continues to thrive due to its cost-efficiency and automation capabilities, making it a favored choice for organizations seeking to optimize operations. The cost benefits, along with resilience-building during disruptions like COVID-19, have propelled RPA's growth. This segment is expected to exhibit a robust CAGR of 30% from 2025 to 2030.

Artificial Intelligence and Machine Learning ("**AI & ML**") technologies play a pivotal role in performance enhancement across industries. Their ability to facilitate data-driven decision-making, automation, and predictive analytics has led to their substantial growth. Businesses are making significant strides in boosting efficiency, process optimization, and security through AI & ML. This segment is expected to maintain a strong CAGR of 42% from 2025 to 2030, as it continues to redefine industries.

Generative AI is a branch of AI that uses machine learning techniques to generate new content that adheres to the underlying patterns in a dataset. Gen AI assists in augmenting datasets for machine learning models. Generative AI is gaining prominence as it enables machines to create content autonomously, such as generating text, images, and even music. This technology is witnessing adoption in creative industries like content generation, design, and art, where AI-driven algorithms can assist or even replace human creativity. The growth of this segment at an expected CAGR of 31% (2025 to 2030), is fueled by the need for efficiencyt content creation, automation of repetitive tasks, and the exploration of AI-driven creativity across various domains.

Metaverse, an emerging technology, is rapidly gaining traction, with estimated spending reaching USD 794 billion in 2030 at a CAGR of 39% (2025 to 2030). The growth is driven by increasing interest and substantial investment in creating immersive digital environments that transcend the boundaries of physical and virtual worlds. With applications ranging from immersive gaming and virtual events to advanced training and simulations, the Metaverse is poised to revolutionize how people interact, collaborate, and entertain themselves in the digital realm.

Cybersecurity expenditure is set to rise due to ongoing cyber risks exacerbated by factors like remote work models, accelerated digital transformation, and economic volatility. Organizations are allocating more resources to safeguard their digital assets, driving steady growth in the bersecurity sector. This segment is expected to maintain a healthy CAGR of 12% between 2025 and 2030.

Immersive Media experiences strong demand as consumers seek differentiated content amid disruptions like COVID-19. Virtual reality ("**VR**"), augmented reality ("**AR**"), and mixed reality ("**MR**") technologies are transforming how people engage with digital content and experiences. The versatility and potential for innovation in immersive media make it a dynamic segment poised for substantial growth with a CAGR of 20% (2025 to 2030).

Cloud Computing maintains its upward trajectory as organizations adopt a 'cloud-first' strategy, leading to increased spending on public cloud services. The scalability and flexibility of cloud infrastructure continue to attract businesses. The adoption of cloud-native technologies and DevOps practices is further accelerating the migration of applications and workloads to the cloud. As cloud providers innovate with advanced offerings such as serverless computing and AI-driven services, the market is poised for a healthy growth to reach a market size of USD 1,688 billion by 2030, growing at a CAGR of 16% (2025 to 2030).

Internet of Things ("**IoT**") plays a pivotal role in enabling data-driven decisions across the industrial and consumer sectors. Post-pandemic, IoT adoption has surged, reflecting its growing importance in connecting devices and collecting valuable data. The convergence of IoT with AI and 5G connectivity is expected to open new possibilities, accelerating the growth of IoT applications across various sectors. This segment is expected to grow at a CAGR of 12% (2025 to 2030) and reach a market size of USD 2,274 billion by 2030.

Computer Vision is emerging as a transformative technology with broad applications. It allows machines to interpret and understand visual information from the world, enabling automation in areas like image recognition, object tracking, and autonomous vehicles. The growth of this segment at a CAGR of 22% (2025 to 2030), is driven by the increasing demand for automation and enhanced visual perception in a wide range of industries.

Global Technology Spend Across Regions

Exhibit 25: Global IT Spending by Regions (2020 to 2030), in USD billion
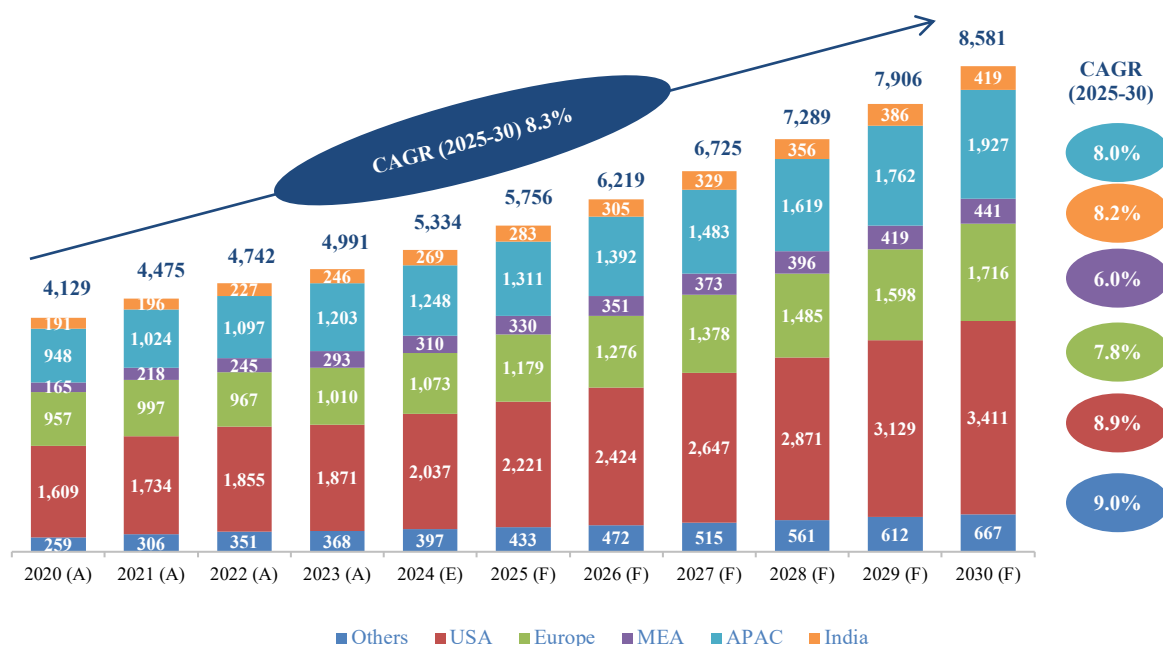
Source: Frost& Sullivan, Secondary Sources

Europe's IT sector is expected to witness significant growth, largely attributed to a strategic shift in focus towards cost control, efficiencies, and automation in response to the challenging economic landscape. This shift, coupled with a strong emphasis on cloud technologies and cloud cybersecurity, is driving IT spending upwards. The sector is also witnessing increased investments in software and IT services, with a notable trend towards cloud options, including infrastructure as a service ("**IaaS**"), expected to grow substantially. Concurrently, there's a heightened priority on enhancing cybersecurity measures, especially in the cloud, to safeguard against emerging threats and to prepare for advancements in AI and generative AI. This focus on security is expected to see a marked increase in spending, at a CAGR of 7.8% (2025 to 2030). Europe's spending is also fueled by Industry 4.0, smart city initiatives, and blockchain-enabled regulatory compliance in finance, healthcare, and trade. Edge and IoT investments focus on energy efficiency, renewable integration, and connected mobility, aligning with EU digital and green transition goals.

Meanwhile, in Africa and the Middle East, there are promising developments. As per a Google-IFC report Africa's internet economy is on the rise and could reach a substantial 180 billion USD by 2025, constituting more than 5% of the continent's GDP. Additionally, Saudi Arabia has ambitious plans to invest 25 billion USD in the tech sector, signalling a strong commitment to technological advancement in the Middle East, at a CAGR of 6% (2025 to 2030). The Middle East is channeling investment into smart city megaprojects, oilfield IoT monitoring, and blockchain-enabled government services, while Africa adopts IoT for agriculture, fintech inclusion, and mobile health.

Turning to the Asia Pacific region, China is expected to experience robust tech spending growth, with at least 8% annual increases projected from 2025 to 2030. Japan is focusing on software and IT services investments, and South-east Asia's domestic tech spending is set to grow by over 9% CAGR. Moreover, long-term investments in research and development ("**R&D**") are expected to further boost tech spending in the Asia Pacific. In this region, technology spending is accelerating in semiconductor manufacturing, AI-powered logistics, and smart infrastructure. Edge computing supports real-time decision-making in industrial hubs, IoT drives connected ecosystems, and blockchain underpins cross-border trade platforms across markets like Singapore, Japan, and Australia.

The increasing adoption of cloud computing, driven by advancements in cloud solutions and data management, is poised to fuel market growth. Cloud services offer numerous advantages, empowering companies to boost their profitability, thereby serving as a key driver for IT spending in the United States market. Similarly, technologies like edge, IoT, and blockchain are driving significant investment in smart manufacturing, autonomous mobility, fintech, and supply chain transparency. Enterprises are expanding data center capacity, deploying industrial IoT, and integrating blockchain into logistics and finance to boost competitiveness and compliance.

Simultaneously, the escalation in the deployment of database management systems ("**DBMS**") is a direct response to the exponential growth in available data for analysis. The surging demand for data services is expected to contribute significantly to the expansion of United States IT spending market. Technology spend in the region is anticipated to grow at a CAGR of 9% from 2025 to 2030, primarily driven by increased R&D investments.

India's technology spending is rising through large-scale IoT deployments in utilities, agriculture, and transport, edge computing in telecom and manufacturing, and blockchain pilots in land registry, supply chains, and fintech. Government digital initiatives and private sector innovation are amplifying adoption.

1.7.2. Global Technology Spend Across Select Industry Verticals

The need to constantly innovate underscores the diverse approaches that industries are taking to leverage technology for growth, efficiency, and resilience. While some sectors were accelerated into digital transformation by the pandemic, others are adapting to emerging trends and opportunities. The outlook for technology spending across these sectors is one of innovation and adaptation, driven by the ever-evolving digital landscape.

Exhibit 26: Global IT Spending Across Industry Verticals (2020 to 2030), in USD billion
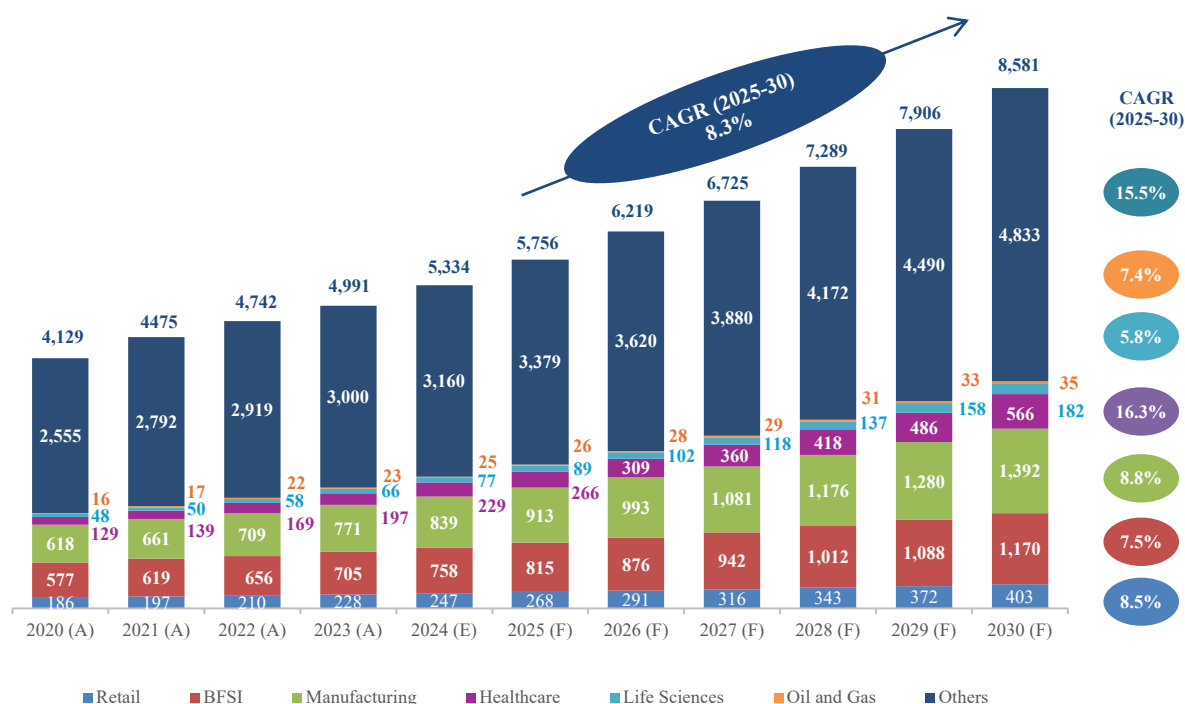
Source: Frost& Sullivan, Secondary Sources

Retail and BFSI sectors have long recognized the importance of technology for their operations. During the pandemic, these industries further embraced digital services for business continuity, leveraging analytics and AI. Technologies like edge computing powers real-time inventory tracking, personalized in-store experiences, and frictionless checkout, while IoT-enabled sensors optimize supply chain and demand forecasting. Blockchain ensures product authenticity and transparent sourcing, prompting retailers to invest heavily in connected store technologies and supply chain platforms. Similarly in BFSI technoogies like blockchain is transforming payments, trade finance, and digital identity verification, reducing fraud and settlement times. IoT supports connected banking services and insurance telematics, while edge computing enhances fraud detection and customer analytics

driving increased investment in secure, scalable digital infrastructure. This trend is expected to continue, with projected growth rates of 7.5% for BFSI and 8.5% for Retail in technology spending between 2025 and 2030. These sectors are primed to continue harnessing technology's power for customer engagement, data-driven decision-making, and operational efficiency.

Manufacturing, traditionally a late adopter of technology, recognized the need to utilize data to improve operational efficiencies. Investments in IoT and automation have gained traction, enabling manufacturers to enhance productivity and respond to unforeseen disruptions like global crises. Edge computing enables predictive maintenance, robotics control, and quality assurance in real time. Blockchain secures supplier data and certifies parts authenticity, fueling spending on Industry 4.0 upgrades and connected factory ecosystems. The IT spending in Manufacturing is projected to grow at a CAGR of 8.8% between 2025 and 2030, reaching USD 1,392 billion by 2030.

Healthcare and Life Sciences have seen unprecedented growth in technology spending due to the demands of managing critical healthcare infrastructure and providing quality care. Technologies like edge computing supports instant diagnostics from connected medical devices, while IoT enables remote patient monitoring and asset tracking. Blockchain secures patient records and enables interoperable health data exchange, prompting healthcare providers to invest in secure, integrated digital care platforms. Healthcare IT spending is expected to grow at a CAGR of 16.3% between 2025 and 2030, reaching USD 566 billion by 2030. Similarly, Life Sciences continues to invest in cutting-edge technology, driving innovation in research and healthcare delivery.

1.7.3. Global IT spend with split and growth by digital versus traditional

Exhibit 27: IT Spending by Digital versus Legacy (2020 to 2030) , USD Billion
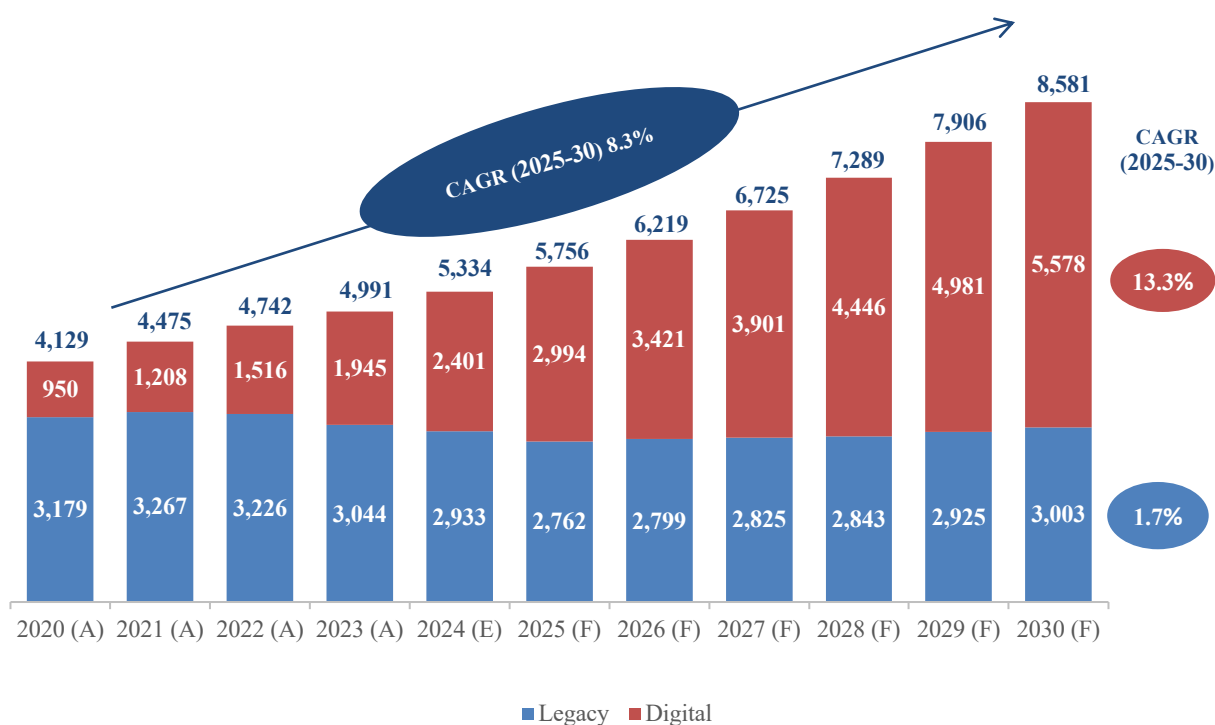
Source: Frost & Sullivan, Secondary Sources

By 2030, the enterprise digital spending is expected to get close to USD 5.8 trillion. Largely this is caused by the continuous evolution and rapid innovation in digital technologies, which have opened up new vistas for businesses. Cloud computing, Artificial Intelligence (AI), blockchain and the Internet of Things ("**IoT**") offer unprecedented opportunities to streamline operations, enhance customer engagement, and gain a competitive edge. Consequently, companies are increasingly recognizing the imperative of embracing digital transformation to stay relevant and competitive in the market.

The modern business landscape demands agility and responsiveness. To keep pace with ever-shifting customer preferences and market trends, organizations are turning to digital solutions. These technologies enable rapid adaptation and empower companies to swiftly implement changes and seize emerging opportunities.

Automation, data-driven insights, and improved resource allocation inherent to digital solutions help companies optimize their operations and reduce operational costs. In an era where efficiency and cost-effectiveness are paramount, this becomes a compelling reason to allocate resources to digital initiatives.

1.8. USA Technology Market Potential

1.8.1. USA Technology Landscape

The USA technology market encompasses a wide range of hardware and software solutions, with industry leaders like Apple, Dell, HP, Cisco Systems, and Intel driving innovation in devices such as smartphones, computers, networking equipment, and semiconductors.

The USA also boasts a thriving software industry, with nearly 4.3 million software developers contributing to the development of applications across various domains, including finance, manufacturing, education, and government services. The software sector is vital for efficient operations, enhancing productivity, security, and service delivery. Additionally, the USA is a major exporter of software, influencing the global software market significantly.

The technology hardware market is poised for substantial growth as well. Factors such as cloud adoption, AI, and IoT are driving demand for powerful servers, specialized processors, and storage solutions. Despite its strong position, the semiconductor industry faces challenges such as rising concerns about e-waste and increased demand due to the COVID-19 pandemic's impact on remote work and learning environments.

USA Technology Market Size & Outlook

The USA information technology market was USD 1,609 billion in 2020. The market is forecasted to be USD 2,221 Bn in 2025 and is expected to reach USD 3,411 billion by 2030 with a CAGR of 9% over the forecast period (2025-2030).

IT companies within the S&P 500 are expected to maintain their outperformance. Software and IT services play a vital role in driving US gross output.

Exhibit 28: USA Information Technology Market (USD Bn) - CY 2020 – 2030F

CAGR (2025-2030): 9%

Year	Hardware / Software & Others	IT Services & BPO	Total
2020	1,064	545	1,609
2021	1,151	583	1,734
2022	1,234	621	1,855
2023	1,246	625	1,871
2024	1,359	678	2,037
2025	1,484	737	2,221
2026	1,622	802	2,424
2027	1,773	874	2,647
2028	1,926	945	2,871
2029	2,103	1,026	3,129
2030	2,296	1,115	3,411

■ Hardware / Software & Others ■ IT Services & BPO
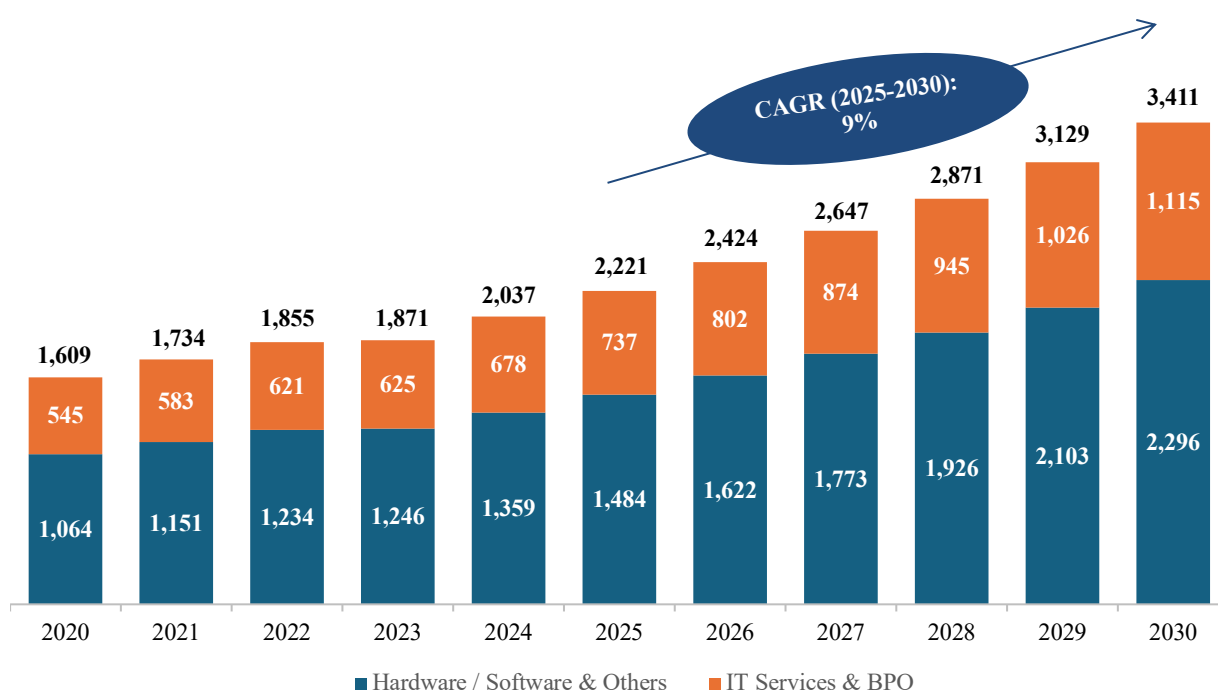
Software expenditure is set to grow nearly twice as fast as any other category, with more than half of the US tech spend growth between 2024 and 2027 anticipated to originate from software. Prepackaged software is expected to witness the swiftest growth. Cloud technology, particularly Microsoft's and Google's cloud revenues, will significantly contribute to this trend.

Besides, IT digital services and emerging technologies like edge computing, IoT, and blockchain have been instrumental in driving robust technology spending as businesses seek speed, connectivity, and trust in a competitive digital economy. Convergence of these technologies is fueling investments in data centers, AI integration, cybersecurity, and cloud-edge infrastructure, with enterprises and government agencies allocating larger budgets to harness these technologies for efficiency, innovation, and market leadership.

1.8.2.   USA Technology Market Spend

Global Technology Spend Across Key Technologies

The dynamic and diverse USA technology landscape thrives on innovation across various sectors. Key emerging technologies include Generative AI, IoT, Cybersecurity, Unified Communications & Collaboration, blockchain and AI & ML. Generative AI fosters creativity, IoT revolutionizes connectivity, edge enables real time analytics, blockchain secures supply chains, financial transactions, and digital identities while Cybersecurity safeguards against threats. Unified Communications & Collaboration platforms streamline communication, while AI & ML drive automation and insights.

Cloud adoption drives demand for powerful hardware infrastructure to handle massive data loads, cementing the US technology market as a global powerhouse shaping innovation and economic growth. Leading companies like Google, Amazon, and Microsoft spearhead advancements, with startups contributing to a vibrant tech ecosystem.

1.   Generative AI: In 2023, North America consolidated its dominance in the global generative AI market, securing over 40% of total global revenues. This leadership is expected to endure, with a projected CAGR exceeding 30% over the next five years, fueled by top-tier technology corporations, notably in the United States. The region's robust demand for AI-driven solutions, particularly in healthcare, finance, and retail sectors, further reinforces its prominence. Generative AI is revolutionizing industries like BFSI, healthcare, and media & entertainment, enhancing tasks such as spam detection and medical imaging while driving innovation. Despite challenges like skill shortages and high costs, cloud storage solutions have played a pivotal role in its advancement, lowering economic barriers and accelerating adoption. Cloud providers like AWS, Microsoft, Google, and Nvidia are poised to benefit from rising demand. Generative AI is expected to drive significant software revenue growth as enterprises seek automation and efficiency enhancements, promising to reshape industries and fuel further innovation. The US, home to leading research institutions and companies like OpenAI and Google DeepMind, remains at the forefront of advancing Generative AI technology.

Exhibit 29: Global GenAI Market Size, 2020-2030 (USD Bn)
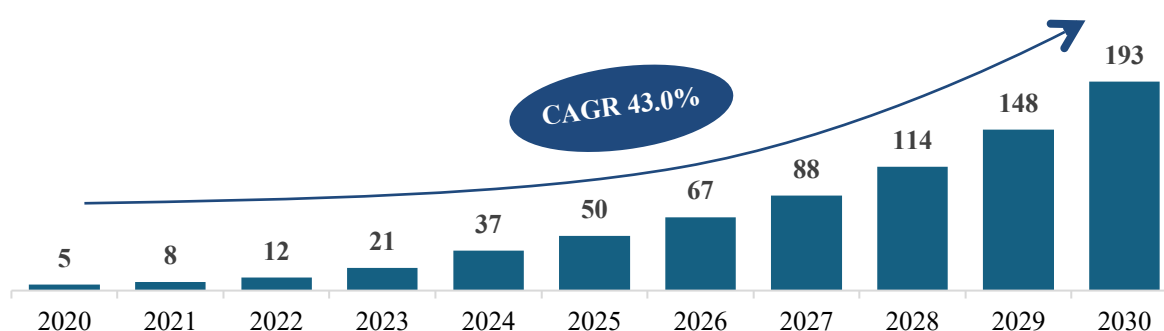
Source: Frost & Sullivan

2. Internet of Things (IoT): The global IoT devices[1] / connections base is projected to reach 105.0 billion units by 2030 from 26.5 billion in 2020, growing at a CAGR of 13.2% with the USA being a significant contributor to this market.

Exhibit 30: Global IoT Devices / Connections, 2020-2030 (Bn)
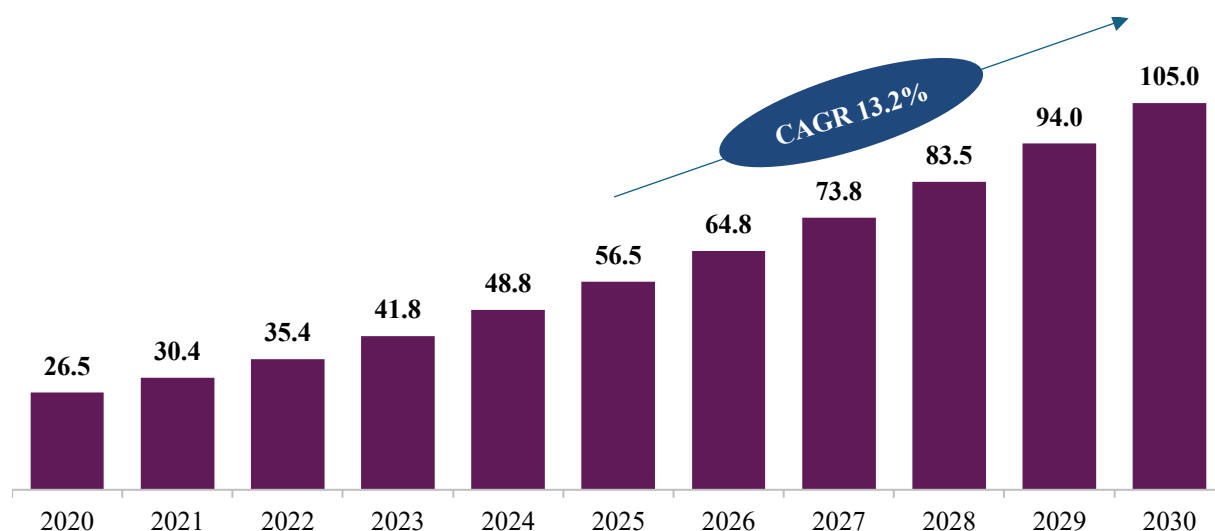
Source: Frost & Sullivan

Exhibit 31: USA IoT Devices / Connections, 2020-2030 (Bn)
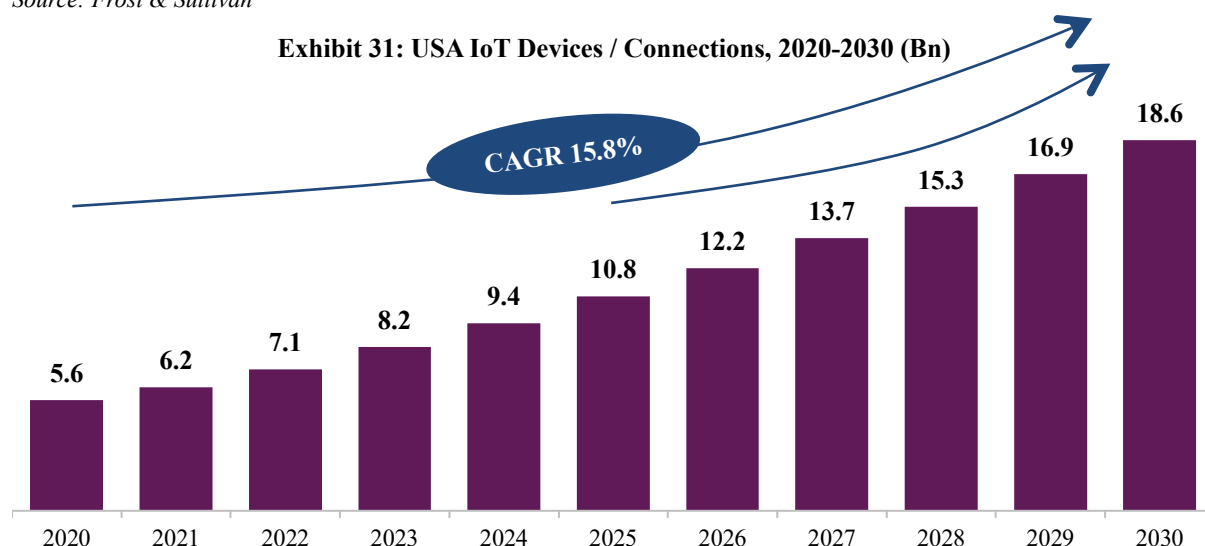
Source: Frost & Sullivan

A recent study conducted in the year 2024 by Parks Associates indicates that 41.9% of US households own at least one smart home device, highlighting a growing trend of consumer adoption. Popular devices include security systems, thermostats, and connected appliances. This proliferation of interconnected devices is transforming various sectors, from smart homes and wearables to industrial automation and connected cities. Leading companies like Cisco, Amazon, and Microsoft are driving this revolution, with applications such as traffic management, waste disposal, and environmental monitoring gaining traction.

3. Cybersecurity: The US continues to be the most targeted nation globally. The year 2023 witnessed an alarming 78% increase in total compromises YoY from 1,801 in 2022 to 3,205 in 2023. The same in 2024 stood at 3,170. This is 70% higher compared to all time high 1,860 compromises in 2021. With the increasing

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[1] A device is defined as one that connects to the network. As it includes all forms of connectivity, IoT devices and IoT connections can be used interchangeably

reliance on technology, cybersecurity is paramount. The US has a robust cybersecurity industry with companies specializing in network security, data protection, and threat detection. Leading firms like Palo Alto Networks and Crowdstrike work to safeguard critical infrastructure and user data.

4. Artificial Intelligence & Machine Learning (AI & ML): While many companies in the USA currently utilize AI, the rest are actively exploring its potential. AI and ML are driving revolutionary changes across numerous industries. The US, with its leading research universities and companies like Google AI, DeepMind, and IBM Research, is at the forefront of AI innovation. Collaboration between government, private companies, and research institutions fosters innovation and addresses societal challenges through AI solutions. Major technology firms like Google, Microsoft, and Amazon heavily invest in AI research, driving advancements in natural language processing, computer vision, and robotics. US-based startups receive a significant portion of global venture capital funding, contributing to a dynamic entrepreneurial ecosystem in the field of AI.

5. Blockchain: Blockchain is a major driver of technology spending, enabling secure, transparent, and tamper-proof transactions across industries. Businesses are investing in blockchain for supply chain traceability, digital identity management, smart contracts, and fraud prevention in finance and insurance. Its ability to streamline compliance, reduce operational costs, and build trust with customers makes it a strategic priority in sectors such as retail, BFSI, healthcare, and logistics. As adoption grows, companies are expanding budgets for blockchain platforms, integration services, and cybersecurity, solidifying its role as a foundational technology in the nation's digital transformation efforts.

Opportunities for Technology Adoption

In the United States, technology adoption pervades all aspects of society, fueling innovation, productivity, and economic expansion. From cutting-edge developments in AI and machine learning to widespread integration of IoT devices, both businesses and consumers embrace technology to streamline operations, improve communication, and tackle complex challenges. The rapid uptake of cloud computing services has transformed data storage, management, and analysis, enabling scalable infrastructure and facilitating remote work, especially evident during the COVID-19 pandemic. Additionally, digital transformation initiatives across various sectors highlight the nation's commitment to enhancing efficiency, accessibility, and sustainability through technology. Yet, challenges such as the digital divide, cybersecurity risks, and ethical considerations surrounding AI prompt ongoing discussions and efforts to ensure responsible and inclusive technology adoption, benefiting all citizens.

Exhibit 32: Opportunities for Technology Adoption
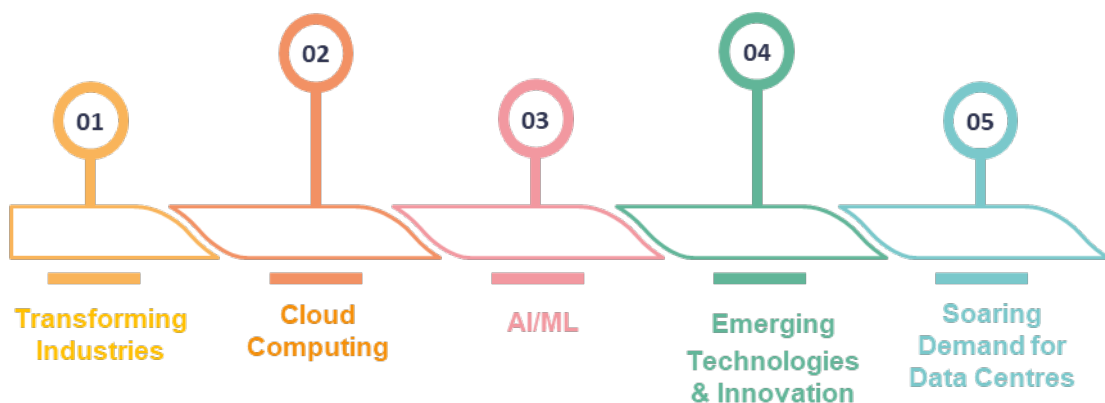
1. **Transforming Industries**

The transformation of industries like healthcare, manufacturing, and oil & gas presents significant opportunities for technology adoption in the USA, fostering innovation, efficiency, and competitiveness. In healthcare, integrating technologies such as electronic health records (EHR), telemedicine platforms, and AI-driven diagnostics can revolutionize patient care, improve outcomes, and streamline operations. Remote patient monitoring and wearable health tech enable proactive healthcare management, alleviating strain on healthcare systems and empowering individuals.

US is witnessing a surge in demand for AI driven data centres. Big Data and AI applications are driving the increased demand. These technologies require substantial computational power and storage capacity, which data centers provide. As organizations leverage Big Data and AI to gain insights, optimize operations, and enhance customer experiences, the demand for data center resources rises.

Moreover, a substantial portion of global companies are engaged in digital transformation initiatives, with 70% actively involved. Similarly, in manufacturing, technology adoption can modernize production processes, boost productivity, and facilitate customization. Automation, robotics, and IoT sensors optimize operations, cut costs, and enhance quality control. Digital twin technology enables simulation and optimization of workflows, fostering agility and responsiveness.

2. Cloud Computing

Cloud Computing remains a transformative force in technology adoption, offering scalable and flexible infrastructure solutions for businesses of all sizes. By migrating to cloud-based platforms and services, organizations can access computing resources on-demand, streamline IT operations, and enable remote work capabilities. Cloud adoption facilitates innovation and agility, allowing companies to rapidly deploy new applications and services to meet evolving market demands. Cloud computing presents numerous opportunities for technology adoption across sectors. These include scalability and flexibility, cost optimization, innovation acceleration, global reach, agile development and deployment, enhanced security and compliance, and advanced data management and analytics. By leveraging these opportunities, organizations can drive efficiency, innovation, and competitiveness in the digital landscape. USA Cloud Computing market is poised to grow from $192 billion in 2023 to $338 billion in 2027, at a CAGR of 15.2% in this period.

3. AI/ML

According to industry reports, the global AI market is projected to reach half a trillion in spending by 2028, from USD 96 in 2023, with the US anticipated to hold a significant share. AI & ML market of US is poised to grow from US$ 30 billion in 2022 to US$166 billion in 2028, at a CAGR of 33% in this period. Emerging technologies like Artificial Intelligence (AI) and Machine Learning (ML) offer vast opportunities for technology adoption across sectors in the USA. These algorithms have the potential to revolutionize processes, drive innovation, and unlock new capabilities in healthcare, finance, transportation, and beyond. As per F&S estimates, total IoT devices / connections is expected to reach 74 billion globally by 2027 up from about 41.7 billion devices / connections in 2023. Building automation, security and surveillance is expected to have about 30 billion of these IoT devices / connections by 2027 – making it the most critical application in the segment. The corresponding numbers for USA is 8.2 billion IOT devices / connections in 2023 growing at a CAGR of 13.6% to reach 13.7 billion devices by 2027. The US plays a pivotal role in IoT development, particularly in healthcare where AI-powered diagnostic tools can enhance early disease detection and personalized treatment plans, improving patient care and outcomes.

In manufacturing, AI and ML enable automation and optimization, with predictive maintenance reducing downtime and supply chain management optimizing logistics routes. Quality control systems empowered by AI enhance product quality and competitiveness in the global market. The National Artificial Intelligence Initiative aims to maintain US leadership in AI R&D, with cities implementing IoT solutions for traffic and waste management. AI and ML adoption foster innovation and entrepreneurship, driving economic growth and job creation. Startups and tech companies in the USA lead in developing AI-powered solutions, with venture capital investment soaring, creating new career opportunities in data science, machine learning engineering, and AI research. Overall, AI and ML are transformative forces poised to reshape industries, drive economic growth, and improve quality of life in the USA.

4. Emerging technologies and Innovation

Emerging technologies such as edge computing, IoT, blockchain, augmented reality (AR), virtual reality (VR), and 5G connectivity are unlocking new opportunities for innovation and growth in the U.S. Edge computing enables real-time data processing at the source, powering faster decision-making in sectors like manufacturing, logistics, and healthcare. IoT connects billions of devices, generating actionable insights that improve efficiency, personalization, and service delivery. Blockchain provides secure, transparent, and tamper-proof data exchange, enhancing trust in applications from supply chain management to financial services. These technologies are

revolutionizing industries, disrupting traditional business models, and creating new avenues for value creation. Government initiatives, public-private partnerships, and R&D investments further accelerate adoption, while collaboration between industry, academia, and policymakers ensures the U.S. remains a global leader in technological innovation and economic growth.

5. Soaring demand for data centres

Global data center investment will continue on a high growth trajectory due to high demand from hyperscale cloud and a high degree of data center activity in emerging economies. The burgeoning AI industry will further accelerate data center investments. A diverse range of industry players, from major hyperscale corporations to prominent colocation operators, small and medium-sized colocation providers, and emerging enterprise data centers, are all concentrating their efforts on AI and its implications on design and infrastructure.

As higher computing densities require more efficient cooling such as direct-to-chip, liquid immersion, and rear door heat exchangers, data center operators are now implementing a strategic approach to construct larger, high-density data center facilities that can accommodate bigger workloads.

Key drivers for data center capex growth

- Expanding demand from hyperscale data centers, especially public cloud providers
- Data center service providers will make large investments to expand their footprint, boosting market growth
- The significant increase in data creation and consumption leads to high demand for data center services
- Emerging technologies, such as 5G, edge, AI/ML, and the Internet of Things (IoT), increase data traffic and speeds
- The dominance of emerging markets, such as new construction activities, spurs investment growth in data centers

Exhibit 33: Data Center Investment Forecast, Global 2020-2030
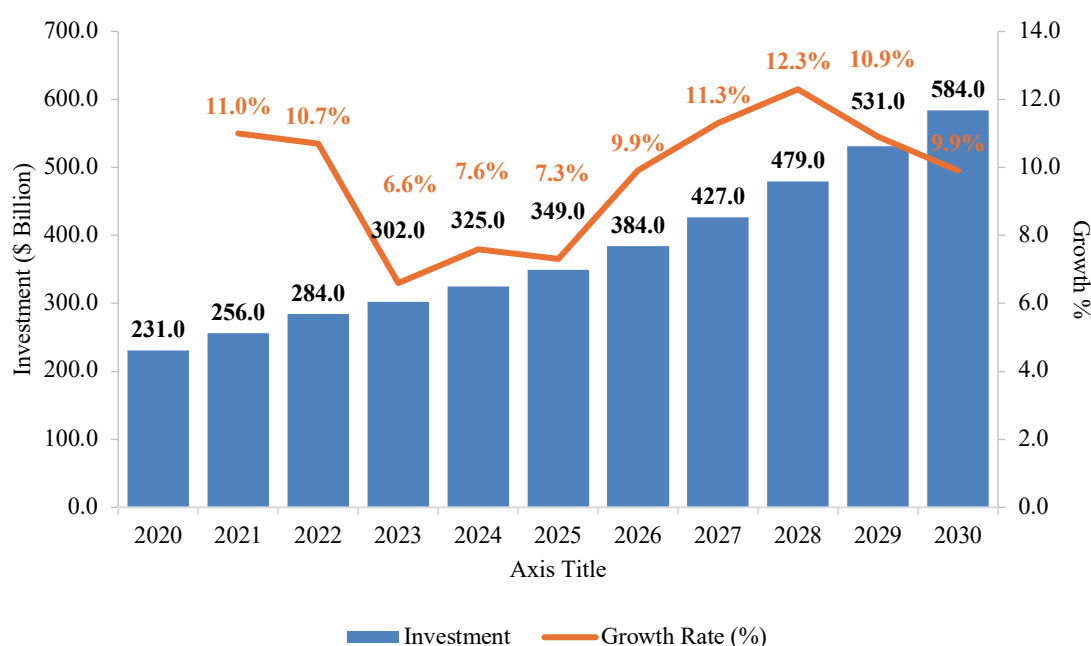
Note: Includes Colocation, Hyperscale and Enterprise data centers
Source: F&S Analysis

Overall, the data centre investment is forecasted to grow from $321 billion in 2020 to $583.8 billion in 2030 at a compound annual growth rate of 10% driven by the proliferation of data usage and investments. Nvidia CEO Jensen Huang predicts that within the next four to five years, the world will witness the construction of data center infrastructure and hardware worth a trillion dollars.

Enabling Big Data and AI

Big Data and AI applications are driving the increased demand for data centers in the USA. These technologies require substantial computational power and storage capacity, which data centers provide. As organizations leverage Big Data and AI to gain insights, optimize operations, and enhance customer experiences, the demand for data center resources rises. Additionally, the adoption of AI and machine learning further contributes to this demand, necessitating specialized infrastructure for efficient processing. Data centres equipped with high-performance computing capabilities play a crucial role in enabling organizations to leverage AI and Big Data effectively, fostering innovation and digital transformation across industries in the USA.

1.8.3. Scaling Connected Devices (Internet of Things (IoT))

The burgeoning Internet of Things (IoT) landscape is a key driver behind the growing demand for data centers in the USA. IoT devices generate vast amounts of data, requiring robust storage and processing infrastructure provided by data centers. As IoT adoption expands across industries like manufacturing, healthcare, and smart cities, data centers play a vital role in managing and analyzing the data generated by these connected devices. Additionally, data centers enable real-time processing for time-sensitive IoT applications, enhancing operational efficiency and decision-making. Investment in data center expansion and innovation is fueled by the increasing demand for infrastructure capable of supporting IoT workloads, reflecting the USA's commitment to IoT-driven innovation and digital transformation.

Exhibit 34: Number of IoT Connections in USA in 2020-2030(in billions)
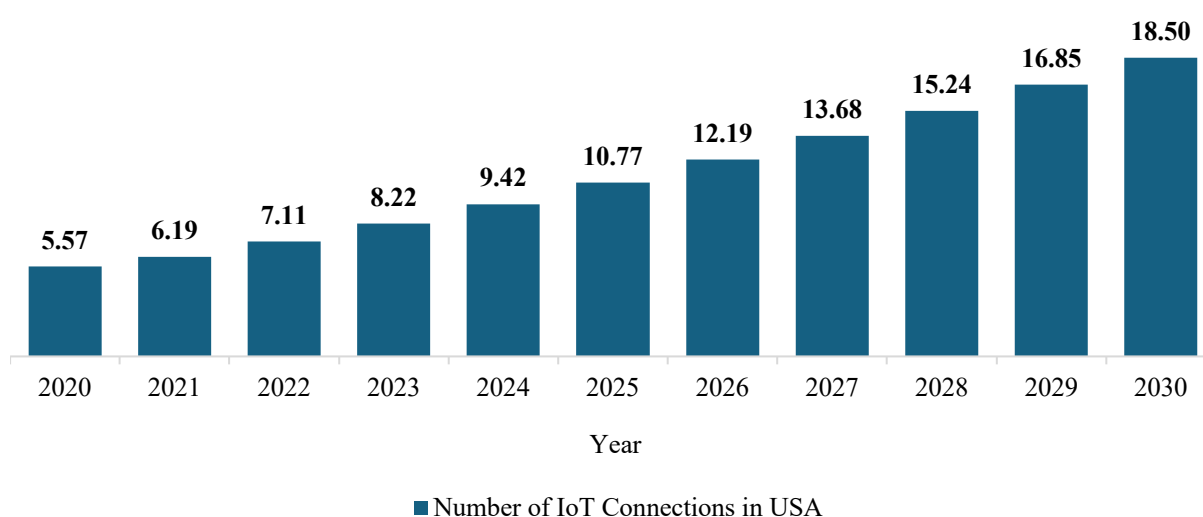
Source: Secondary sources, F&S Analysis

1.8.4. US Technology Spend Across Key Segments (Hardware, Software, and IT Services)

Tech spending in the U.S. can be broadly categorized into three key segments: **hardware**, **software**, and **IT services**. Each of these areas plays a distinct role in enterprise IT and has its own drivers, challenges, and growth outlook. Historically, the mix of spending has shifted significantly – hardware (devices, infrastructure, etc.) once dominated IT budgets, but over the past decade software and services have taken the lead as organizations prioritize digital solutions and cloud-based operations. The U.S. is the largest tech market in the world and thus mirrors many global trend.

As of 2025, U.S. tech spending (including enterprise and government technology expenditures) is projected to reach approximately $2.2 trillion. This figure includes everything from data center hardware and devices to software licenses, cloud subscriptions, IT consulting, and more. Below is a breakdown of each major segment – hardware, software, and IT services – including their historical context, current drivers of growth, challenges faced, and future opportunities:

Hardware

In the U.S., hardware remains a substantial part of IT spend (hundreds of billions of dollars annually).

Current Drivers & Opportunities: Heading into 2024–2025, the hardware segment is seeing renewed pockets of growth driven by emerging needs:

Exhibit 35: Current Drivers & Opportunities for U.S. IT Hardware Revenue

Current Drivers & Opportunities for U.S. IT-Hardware Revenue	
1. AI-centric compute demand	6. Federal & critical-infrastructure cyber rules
2. Edge-to-core infrastructure refresh	7. Automotive compute & sensor boom
3. CHIPS & Science Act + state incentives	8. IoT & smart-manufacturing scale-out
4. Data-center decarbonization mandates	9.Government digital-infrastructure programs:
5. Hybrid-work device replacement cycle	10. Quantum & exascale HPC initiatives

- **AI-centric compute demand:** Generative-AI training, LLM fine-tuning, and real-time inference are now board-level priorities, pushing hyperscalers and Fortune 500 private clouds to lock in multi-year orders for high-density GPUs/ASICs, HBM memory, advanced NICs, and liquid-cooled racks. This "AI acceleration" wave is expected to remain the single largest pull-through for servers, power-delivery subsystems, and data-center infrastructure well into the 2030 horizon.
- **Edge-to-core infrastructure refresh:** Low-latency analytics, computer-vision inspection, and private 5G/6G roll-outs are driving a new class of rugged edge servers, micro-data-centers, industrial PCs, and upgraded campus/branch networking. Modular, AI-ready edge appliances—distributed through telcos and OT integrators—help enterprises keep data local while remaining cloud-connected.
- **CHIPS & Science Act + state incentives:** More than $50 billion in federal subsidies, layered on top of generous state tax breaks, underwrite new fabs, advanced-packaging plants, and semiconductor R&D clusters. Equipment makers (lithography, deposition, metrology) and facility-grade IT (SCADA servers, HPC clusters inside fabs) enjoy predictable order backlogs through decade-end.
- **Data-center decarbonization mandates:** Rising electricity prices, SEC climate-risk disclosures, and aggressive state ESG laws compel operators to adopt energy-efficient servers, liquid/immersion cooling, and on-site renewables. ARM-based processors, liquid-cooled racks, and power-management software command premium pricing as "green-compute" shifts from nice-to-have to compliance requirement.
- **Hybrid-work device replacement cycle:** Pandemic-era PCs are aging out; 2025-era "AI-PCs" with on-device co-processors, Wi-Fi 7, and secure silicon (e.g., Microsoft Pluton) launch a corporate refresh wave. Device-as-a-Service (DaaS) contracts boost recurring revenue, while higher DRAM/SSD (Dynamic Random-Access Memory, main system memory in a computer/ Solid-State Drive, the primary storage device in most modern PCs) configurations lift average selling prices.
- **Federal & critical-infrastructure cyber rules:** The 2024 National Cybersecurity Strategy Implementation Plan mandates zero-trust, post-quantum cryptography, and hardware-rooted security across agencies and utilities. TPM 2.0+, memory-encryption engines, and secure firmware modules quickly become table stakes for government and regulated-industry procurements.
- **Automotive compute & sensor boom:** EV adoption and ADAS levels 3-4 demand onboard AI chips, lidar/radar packs, zonal controllers, and high-speed in-vehicle networks; U.S. assembly expansion

(Michigan, Tennessee, Georgia) localizes supply chains. Traditional IT silicon vendors now partner with Tier-1 auto suppliers, blurring lines between datacenter and drivetrain compute.

- **IoT & smart-manufacturing scale-out:** Reshoring incentives and IIoT (Industrial Internet of Things) tax credits spur factory and warehouse deployments of sensors, gateways, and 5G/Time-Sensitive-Networking switches. Cyber-certified industrial PCs and low-cost MCUs drive volume, while analytics-ready gateways create add-on software revenue.
- **Government digital-infrastructure programs:** Broadband-equity (BEAD) funds, grid-modernization grants, and VA/DoD (U.S. Department of Veterans Affairs/ U.S. Department of Defense) health-IT upgrades translate into routers, optical gear, rugged tablets, and medical-grade servers. Vendors that satisfy Buy-American and secure-supply-chain rules unlock sizable public-sector pipelines.
- **Quantum & exascale HPC initiatives:** National Quantum Initiative extensions and DOE exascale budgets accelerate demand for cryogenic computers, photonic interconnects, and novel memory technologies. Though niche today, early ecosystem participation secures IP positions and standards leadership for the late-decade market.

Combined, these drivers keep U.S. IT-hardware revenue on a mid-single-digit CAGR through 2030, with AI accelerators, secure edge servers, and energy-efficient PCs outpacing legacy categories. Energy-efficient and security-certified designs offer premium margins, while supply-chain tightness and macro swings remain watch points.

Key Challenges: Despite the areas of growth, the hardware segment faces several challenges:

- **Persistent supply-chain volatility:** While domestic fabs are ramping, the U.S. hardware stack still relies heavily on overseas substrates, advanced packaging, specialty chemicals, and rare-earth magnets. Any fresh pandemic wave, South-China-Sea tension, or shipping bottleneck can jeopardize component flow, stretching lead times and inflating bills-of-materials just as enterprises plan large AI and PC refreshes.
- **Talent & training bottlenecks:** The semiconductor workforce gap is projected to exceed 60 000 skilled positions by 2030. A shortage of lithography engineers, firmware developers, and precision-tool technicians slows fab startups, constrains board design cycles, and raises labor costs across OEMs and hyperscalers.

Exhibit 36: Key Challenges for U.S. IT Hardware Revenue

Key Challenges for U.S. IT-Hardware Revenue	
1. Persistent supply-chain volatility	6. ESG compliance cost drag
2. Talent & training bottlenecks	7. Fragmented AI-accelerator standards
3. CapEx squeeze from high interest rates	8. Consumer device saturation & budget fatigue
4. Energy-grid constraints & permitting delays	9. Regulatory uncertainty on export controls
5. Security & IP-theft risks in globalized design chains	10. Capital-intensive fab overbuild risk

- **CapEx squeeze from high interest rates:** Elevated financing costs dampen hyperscaler data-center buildouts and delay mid-market server refreshes. Municipal bond markets face similar pressure, risking slippage in broadband- and smart-grid roll-outs that otherwise drive hardware demand.
- **Energy-grid constraints & permitting delays:** Rapid AI-data-center expansion clusters around a handful of metros, straining local transmission capacity. Lengthy permitting for sub-stations, renewables, and liquid-cooling plants can freeze new rack deployments for 18-24 months, throttling server, switch, and storage orders.
- **Security & IP-theft risks in globalized design chains:** Even "made in America" devices embed firmware and IP blocks sourced worldwide. Supply-chain firmware implants, counterfeit chips, and design-file leaks expose OEMs to costly recalls and regulatory fines, eroding buyer confidence.
- **ESG compliance cost drag:** Scope-3 emissions reporting, e-waste take-back mandates, and looming right-to-repair rules force manufacturers to redesign products for recyclability and traceability. Margin-diluting redesign cycles divert R&D dollars from next-gen performance features.
- **Fragmented AI-accelerator standards:** Competing chip architectures (x86+GPU, ARM+NPU, RISC-V accelerators) and interconnect specs (NVLink, CXL, PCIe Gen 6) fragment software stacks and lock buyers into vendor silos—slowing enterprise decision-making and elongating qualification cycles.
- **Consumer device saturation & budget fatigue:** Household PC, tablet, and smartphone penetration is near ceiling levels; incremental "AI-PC" features may not justify premium pricing for cost-conscious consumers facing inflation, limiting upside for client-device volumes.
- **Regulatory uncertainty on export controls:** Expanding U.S. restrictions on advanced GPU and lithography exports spawn retaliatory trade measures, clouding demand visibility for vendors that rely on multinational scale and shared R&D road maps.
- **Capital-intensive fab overbuild risk:** Subsidy-fuelled capacity coming online in 2026-29 could overshoot demand if macro conditions soften, triggering pricing pressure for memory, logic, and power-device suppliers—and cutting into funds for iterative node investments.

Together, these challenges cap U.S. hardware growth to a low single-digit range in down-cycle years and could compress margins even when unit demand is healthy. Successful vendors will derisk supply chains, invest in workforce pipelines, harden security at every tier, and design modular, energy-efficient products that meet tightening ESG and regulatory demands without inflating total cost of ownership.

Software

In today's market, software is the fastest-growing area of IT spending and a primary engine of technology-driven innovation. U.S. businesses have been aggressively increasing software investments as they digitize operations and move to subscription-based cloud software models.

Exhibit 37: Current Drivers & Opportunities for U.S. IT Software Revenue

Current Drivers & Opportunities for U.S. IT-Software Revenue	
1. Generative-AI everywhere	6. Vertical SaaS deepening
2. Cloud-native modernization wave	7. Edge & IoT software spend
3. Cybersecurity escalation & zero-trust mandates	8. Hybrid-work digital experience
4. RegTech & compliance automation	9. Data-fabric & real-time analytics
5. Low-code / no-code democratization	10. Government & CHIPS-plus-Science act funding

Current Drivers & Opportunities: The software segment's strong growth in the U.S. is fueled by multiple drivers:

- **Generative-AI everywhere:** Explosive adoption of large-language-model tooling is pushing enterprises to license new AI platforms, vector databases, and orchestration stacks; software budgets are shifting toward copilots, content-automation suites, and AI API consumption fees—opening multi-billion-dollar TAMs even in mature verticals.
- **Cloud-native modernization wave:** By 2025, half of U.S. production workloads are expected to run in containers or serverless footprints. Lift-and-shift is giving way to refactor/re-platform projects that drive demand for Kubernetes management, service meshes, and cloud FinOps software, boosting ARR for hyperscaler marketplaces and third-party SaaS vendors alike.
- **Cybersecurity escalation & zero-trust mandates:** Rising ransomware losses and stricter SEC cyber-incident disclosure rules are compelling companies to expand spending on identity-and-access management, cloud-workload protection, and AI-driven threat hunting; the fragmented vendor landscape fuels double-digit growth for platform consolidators.
- **RegTech & compliance automation:** A surge of ESG reporting, data-privacy (CPRA), and AI-governance regulations is spawning demand for policy engines, audit trail ledgers, and continuous-controls monitoring software—turning compliance from a cost center into an analytics-driven service opportunity.
- **Low-code / no-code democratization:** Talent shortages and the need for rapid iteration are propelling adoption of visual development platforms that let business users build apps, bots, and data pipelines—expanding the software buyer base beyond IT and embedding subscription spend in line-of-business budgets.
- **Vertical SaaS deepening:** Industry-specific clouds for healthcare, manufacturing, and public sector are layering analytics, AI, and IoT integrations atop core ERP/CRM stacks, capturing sticky domain workflows and driving higher ARPU than horizontal SaaS peers.
- **Edge & IoT software spend:** As 5G and private-wireless rollouts proliferate, enterprises need lightweight OSs, device orchestration, and real-time data-stream processing at the edge—creating a parallel software market adjacent to centralized cloud and boosting subscriptions for observability and AIOps tools.
- **Hybrid-work digital experience:** Persistent remote and flexible work models keep fueling demand for collaboration suites, digital employee experience monitoring, and SaaS security gateways, anchoring predictable, renewals-heavy revenue streams.

- **Data-fabric & real-time analytics:** Competitive pressure for instant insights is shifting spend from traditional BI to in-memory, streaming, and graph analytics platforms; data-mesh architectures drive purchases of cataloging, lineage, and governance software that binds multi-cloud data estates.
- **Government & CHIPS-plus-Science act funding:** Federal incentives for semiconductor, energy, and defense modernization include sizable software allotments for digital-twin simulations, secure-supply-chain platforms, and AI research infrastructure—injecting public dollars into domestic ISVs and cloud providers.

These forces combine to propel U.S. software outlays into a sustained high CAGR through to 2030, with subscription models cushioning macro cycles and AI-driven productivity gains justifying budget expansions even under flat head-count scenarios. Vendors that unify AI, security, and industry context into seamless cloud offerings are poised to capture the bulk of incremental spend.

Key Challenges: Despite strong drivers, the software segment faces some challenges and considerations:

Exhibit 38: Key Challenges for U.S. IT Hardware Revenue

Key Challenges for U.S. IT-Hardware Revenue	
1. **Macro-economic caution & IT budget compression**	6. **Compute-cost explosion for AI workloads**
2. **SaaS sprawl and value-realization fatigue**	7. **Interoperability & vendor lock-in fears**
3. **Skills shortfall & wage inflation**	8. **Open-source commoditization & pricing pressure**
4. **Regulatory drag & compliance ambiguity**	9. **Capital-market retrenchment**
5. **Security & resilience concerns**	10. **Sustainability scrutiny**

- **Macro-economic caution & IT budget compression:** Persistent rate volatility, softening consumer demand, and lingering recession fears keep CFOs in a defensive stance, stretching refresh cycles and forcing "do-more-with-less" mandates that can delay green-field software projects or downsized SaaS seat counts.
- **SaaS sprawl and value-realization fatigue:** After a decade of "there's an app for that," many enterprises run hundreds of subscriptions with overlapping features; CIOs are pivoting to consolidation and license-rationalization, capping net-new ARR for niche ISVs and pressuring vendors to show hard ROI.
- **Skills shortfall & wage inflation:** Generative-AI, cloud-native, and cybersecurity expertise remain scarce; six-figure salaries and high turnover inflate total cost of ownership and slow deployment timelines, eroding the payback narrative for advanced software investments.
- **Regulatory drag & compliance ambiguity:** Emerging rules on AI transparency, data-sovereignty, ESG reporting, and cross-border privacy (CPRA, proposed federal privacy act, EU-U.S. data-transfer friction) create legal uncertainty and raise integration costs, discouraging rapid rollout of new platforms.
- **Security & resilience concerns:** Rising breach volume and the SEC's 4-day incident-disclosure rule increase executive liability; buyers tighten third-party–risk assessments, elongating sales cycles for cloud and AI offerings and elevating the bar for compliance certifications.

- **Compute-cost explosion for AI workloads:** Scarce GPUs, soaring electricity prices, and data-center capacity constraints can make AI-heavy SaaS economics untenable, forcing vendors to raise prices or throttle usage—both potential dampers on broader market expansion.
- **Interoperability & vendor lock-in fears:** Proprietary AI stacks, divergent data-mesh standards, and multi-cloud egress fees complicate portability; enterprises hesitate to commit to platforms that could trap data or models, slowing deal closure and favoring incremental over transformative buys.
- **Open-source commoditization & pricing pressure:** Mature OSS alternatives (Linux Foundation AI, OpenTelemetry, PostgreSQL forks) undercut commercial licenses; vendors must differentiate on value-added services, squeezing gross margins and limiting headroom for aggressive growth targets.

- **Capital-market retrenchment:** Post-pandemic valuation resets and tighter venture funding mean fewer moon-shot bets and slower scale-ups for emerging software players, reducing the pipeline of disruptive entrants that typically energize demand.
- **Sustainability scrutiny:** Data-center carbon footprints are drawing regulatory and investor attention; software projects lacking a clear energy-efficiency story may face stakeholder push-back, particularly in ESG-committed enterprises and government bids.

These factors combine to create a more disciplined, risk-averse buying climate through 2030. Growth will still occur, but vendors must pivot from "land-grab" to "land-and-expand with verified value," emphasize interoperability, and embed security-and-compliance by design to overcome procurement hurdles and muted budget elasticity.

1.9. Global IT Services Industry Overview

The global **IT services industry** has experienced robust growth from 2020 to 2025 and is poised for continued expansion through 2030. IT services encompass a broad range of activities – from technology consulting and systems integration to outsourcing, technical support, and business process outsourcing (BPO). Globally, IT services form a significant category of enterprise tech spending, reflecting organizations' heavy reliance on external IT expertise and managed solutions. In fact, the global IT services spending reached about US$1.412 trillion in 2024 and is estimated to reach US$ 2.131 trillion by 2030, making it one of the biggest segment of worldwide IT expenditures. This surge was driven by enterprises upgrading infrastructure and adapting to new operational demands – notably accelerated digital transformation efforts and cloud adoption in the wake of the COVID-19 pandemic. Post 2020, many organizations fast-tracked projects like cloud migrations, digital platforms, and remote work enablement, boosting demand for IT consulting, integration, and support services. At the same time, economic uncertainties and post-pandemic budget pressures led companies to prioritize IT investments that improve efficiency and optimize operations. IT service providers have been central to these efficiency and modernization initiatives, helping enterprises navigate challenges from legacy system upgrades to new cybersecurity threats.

Exhibit 39: Global IT Services Market (USD Bn) - CY2020 – 2030F
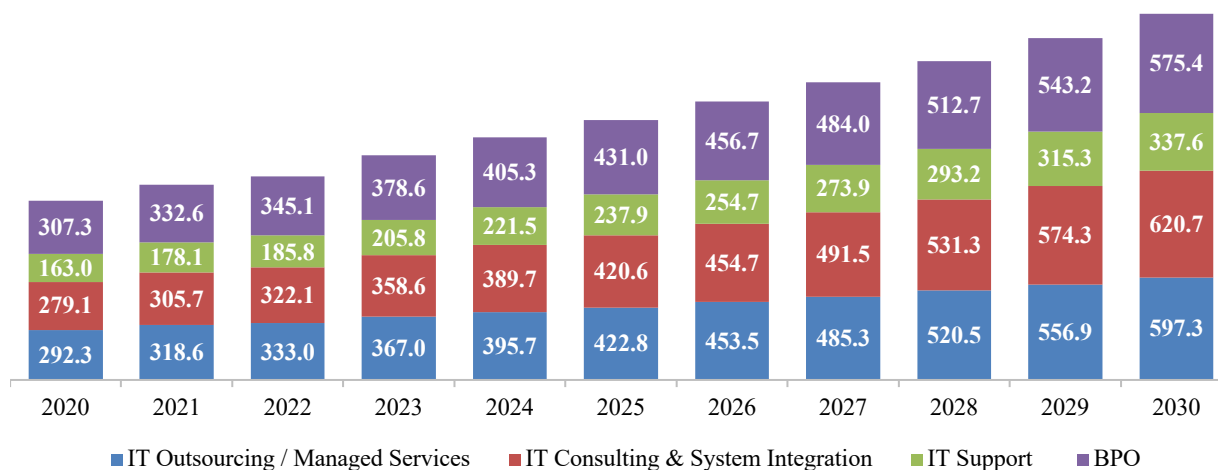
Source: Frost & Sullivan analysis

Looking forward to 2025–2030, as per Frost & Sullivan estimates, the IT services market is expected to reach US$ 2,131 billion growing at a CAGR of 7.1% in the same period.

Key trends powering this growth include the mainstreaming of cloud and "as-a-service" models, rising adoption of AI and automation, and an ongoing enterprise focus on digital transformation. For the worldwide IT spend, a significant portion will be driven by investments in software, cloud infrastructure, and AI-enabled services. Generative AI in particular is emerging as a catalyst for IT spend – prompting hardware upgrades and new AI-based services – though its impact will be gradual and mainly seen in the latter half of the decade. Crucially, IT services firms and cloud "hyperscalers" (large cloud providers) are expected to grow stronger, underscoring how services (from consulting to managed cloud offerings) dominate the tech landscape. Enterprises are increasingly not just buying products, but partnering with service providers to achieve outcomes – whether optimizing business processes, migrating to hybrid cloud architectures, or leveraging advanced analytics.

Market Drivers

Several drivers underpin the global IT services boom:

Exhibit 40: Market Drivers for Global IT Services
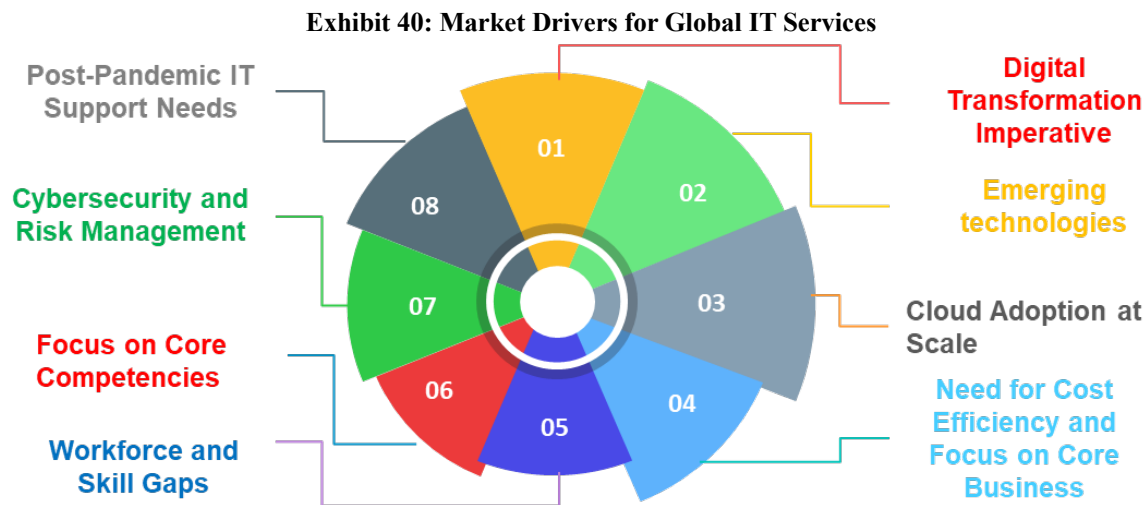
- **Digital Transformation Imperative:** Across industries, organizations see technology modernization as essential for competitiveness. Enterprises worldwide have been pursuing digital transformation initiatives by mid-decade, from modernizing legacy systems to deploying data analytics and AI solutions. This has in turn fuelled demand for IT consulting and integration services as companies seek external expertise to implement cloud, AI, and data-driven projects.
- **Emerging technologies:** Emerging technologies like blockchain, IoT, and edge computing—etc. are transforming how organizations design, deploy, and manage digital solutions. These technologies are accelerating demand for IT services in consulting, systems integration, managed services, cybersecurity, and cloud-edge infrastructure. As enterprises and governments invest heavily in digital transformation, IT service providers are expanding capabilities to deliver end-to-end solutions that integrate these innovations, fueling sustained market growth and redefining global technology competitiveness.
- **Cloud Adoption at Scale:** The 2020s have seen a massive shift to cloud infrastructure and software-as-a-service. Enterprises globally have increasingly migrated workloads to cloud platforms (public, private, or hybrid), aiming for greater agility and cost efficiency. Multi-cloud and hybrid cloud strategies are now common, creating demand for integrators to stitch together on-premise and cloud systems. Cloud adoption drives needs for cloud consulting, cloud management (a core managed service), and cloud-enabled support. IT infrastructure and application services tied to cloud are a major growth area in IT services.
- **Need for Cost Efficiency and Focus on Core Business:** Especially during economic uncertainties (e.g. pandemic disruptions, inflationary periods), companies have leaned on outsourcing and managed services to control costs and improve focus. Cost optimization has traditionally been a top reason to outsource IT work in 2020. Post-2020, while cost is still important, businesses also seek more value-added benefits (like access to skilled talent and improved service quality) from providers. Nonetheless, the fundamental motivation to "do more with less" remains, sustaining demand for IT services that can increase operational efficiency.
- **Workforce and Skill Gaps:** The rapid pace of tech innovation has led to shortages of in-house skills in areas like cloud architecture, AI/ML, cybersecurity, and data science. This lack of internal talent drives organizations to partner with external providers for emerging technologies. For instance, companies that lack AI or cloud experts will hire consulting firms or managed service providers to fill those gaps. Globally, many IT service providers are experiencing a talent shortage in specialized skills (AI, DevOps, security, etc.) and see that as a major challenge. Thus, accessing skilled human capital is a critical driver for the IT services outsourcing market.
- **Focus on Core Competencies:** Beyond technical skills, companies increasingly outsource non-core IT functions (infrastructure management, helpdesks, routine back-office processes) so they can concentrate

on strategic, core business activities. This trend has bolstered BPO and managed IT services, where specialist vendors run supporting operations more effectively.

- **Cybersecurity and Risk Management:** With cyber threats proliferating, enterprises are investing heavily in security services. Many turn to external security consultants, managed security service providers, and support providers to protect data and infrastructure. Companies have increased IT security budgets in recent years due to rising threats and regulations. This has made security a significant driver across all IT service segments – from consulting on security strategy, to outsourcing security operations (SOC monitoring), to helpdesk support for security tools.

- **Post-Pandemic IT Support Needs:** The COVID-19 era (2020–2022) forced a sudden shift to remote work and digital customer engagement, straining IT support models. Organizations had to rapidly deploy remote collaboration tools and provide support for distributed workforces. This spurred demand for cloud-based IT support services and external support partners. In fact, remote work models worldwide increase in use of cloud-based collaboration and IT support services. The pandemic essentially elevated IT services from a back-office role to a frontline enabler of business continuity.

Opportunities and Emerging Trends: Alongside these drivers, new opportunities are shaping the future of IT services:

Exhibit 41: Opportunities & Emerging Trends for Global IT Services

- **AI and Automation Services:** The integration of artificial intelligence is a game-changer for IT services. Enterprises are increasing investments in AI-driven automation to improve accuracy and efficiency. Service providers are embedding AI into operations – e.g. AI for network monitoring (AIOps), AI chatbots for support, and AI analytics in consulting. Generative AI is a particularly hot area. As AI adoption grows, IT services firms are offering AI advisory, implementation, and managed AI services, making this a key growth opportunity into 2030. Automation is also reshaping outsourcing – routine tasks in support and BPO are increasingly handled by RPA (robotic process automation) and intelligent bots, allowing service vendors to deliver faster and cheaper service.

- **Outcome-based and Value-driven Engagements:** Clients are expecting more than cost savings – they seek **business outcomes** and agility from IT partners. This is shifting service contracts toward outcome-based models (where payment is tied to results achieved) and flexible "as-a-service" arrangements. For example, in consulting, instead of lengthy fixed projects, some firms now offer "consulting as a service" subscriptions to provide on-demand expertise in a fast-changing environment. In outsourcing, there is a noted trend that companies now emphasize talent quality, innovation, and fast delivery from providers almost as much as cost control. This is an opportunity for service firms to differentiate via higher-value offerings (innovation labs, co-creation with clients, continuous improvement commitments, etc.).

- **Cloud-Native and Edge Solutions:** As cloud adoption matures, the next opportunity is managing complex hybrid multi-cloud environments and pushing computing to the edge. IT service providers are capitalizing by offering cloud optimization services, cloud integration, and edge computing solutions (e.g. managing

IoT devices and edge data centers). The proliferation of cloud services also means enterprises need guidance on architecture, governance, and cost management fueling ongoing consulting engagements and managed cloud services. Cloud and edge are thus key growth areas through 2030.

- **Industry-Specific and Consultative BPO:** In BPO, providers are moving up the value chain to offer knowledge process outsourcing (KPO) and industry-specialized services. Rather than just generic back-office work, BPO firms now provide domain-specific expertise – for example, in healthcare BPO handling medical coding with high accuracy, or in finance BPO providing risk analytics support. The evolution to KPO is enabled by technology (AI can handle data-heavy tasks) and by clients' willingness to outsource more complex functions to trusted partners. This is seen as a major opportunity, as BPO moves from just cost play to a value play.

- **Remote and Global Delivery Models:** The acceptance of remote work has expanded the talent pool and delivery models for IT services. Providers can now tap experts globally without relocating them, and clients are more comfortable with virtual project delivery. This trend benefits offshore and nearshore outsourcing destinations. Countries like India, Poland, the Philippines, Mexico, and others with strong IT talent continue to see high demand as service delivery hubs. Service firms are seizing this opportunity by building distributed teams and follow-the-sun support models, offering 24/7 services and resilience. The flip side is increased competition and the need for collaboration tools – which themselves drive IT consulting on remote work solutions.

- **Sustainability and "Green IT" Services:** An emerging area of opportunity is helping clients achieve sustainability goals via IT. This includes services like data center energy optimization, e-waste management, and using IT for ESG (environmental, social, governance) reporting. While still nascent, more companies are interested in "green IT" consulting and outsourcing (for example, optimizing cloud usage for lower carbon footprint, or outsourcing to providers with renewable-powered centers). This trend is expected to grow towards 2030 as sustainability pressures mount on the tech industry.

The global IT services landscape has been marked by accelerating digital initiatives, a push for cloud and efficiency, and greater reliance on external experts amid rapid tech change. From 2025 onward, emerging technologies (AI, automation, edge) and evolving client demands (value-driven partnerships, industry-specific solutions) are set to shape the market.

1.9.1.   Global IT Consulting & System Integration

IT Consulting & Systems Integration refers to project-based technology services, experts advising organizations on IT strategy and implementing complex systems or software solutions. This segment includes activities like technology consulting, solution architecture, software development and integration, enterprise system implementation (ERP, CRM, etc.), and IT project management. Essentially, when a business undertakes a digital transformation initiative – be it adopting a new cloud platform, integrating data across systems, or rolling out an AI solution, they often engage IT consulting and integration partners to plan and execute the project. Post 2020, this segment grew steadily as companies invested in modernizing their IT for competitiveness. Enterprises worldwide have been prioritizing such project-oriented services and have had active digital modernization programs, leading to a surge in consulting demand as clients sought guidance on cloud, analytics, and emerging tech adoption. Even amid the pandemic, consulting firms stayed busy helping firms go digital quickly (for example, deploying e-commerce and remote working solutions in 2020–21). However, some traditional large-scale integration projects were delayed in early 2020 due to uncertainty, only to rebound strongly by 2022 once the strategic need became evident. By 2024, IT consulting was in high demand for cloud migration strategies, cybersecurity enhancements, and data analytics implementations, among other priorities.

The global IT Consulting and system integration market was valued at US$ 279 billion in 2020 and grew to reach an estimated US$ 390 billion by 2024. Looking forward to 2025–2030, as per Frost & Sullivan estimates, global IT Consulting and system integration market is expected to reach US$ 621 billion growing at a CAGR of 8.1% in the same period.

1.9.2.   Global IT Outsourcing / Managed Services

IT Outsourcing / Managed Services covers the ongoing operational management of IT assets and processes by third-party service providers. This includes infrastructure outsourcing (managing data centers, networks, end-user

devices), application management (maintaining and supporting software applications), cloud managed services (operating cloud environments for clients), outsourced IT service desks, and overall Managed IT Services where a provider takes responsibility for delivering a defined set of IT services under a contract (often with SLAs). In essence, rather than handling all IT in-house, companies contract external providers to run certain IT functions continuously. Post 2020, this segment grew as companies sought efficiency, reliability, and scalability in IT operations. Notably, 2020 saw a short-term disruption in some outsourcing (e.g. BPO call centers had to adapt to work-from-home), but overall the pandemic reinforced the value of managed services: companies pivoted to remote operations with the help of outsourcers (for VPN management, cloud support, etc.), and many who needed to cut costs accelerated outsourcing non-core IT tasks.

Organizations continue to offload routine IT activities (like infrastructure upkeep, basic support, software maintenance) to specialized providers, freeing up internal teams for strategic work. Moreover, the rise of cloud computing changed the nature of outsourcing – instead of traditional legacy IT outsourcing alone, providers began offering cloud-managed services, DevOps as a service, security as a service, etc., catering to modern IT environments. The period also saw large deals in outsourcing, including more "managed services" contracts where vendors deliver outcomes (performance, uptime, etc.) for a fixed monthly fee.

The global IT outsourcing market was valued at US\$ 292 billion in 2020 and grew to reach an estimated US\$ 396 billion by 2024. Looking forward to 2025–2030, as per Frost & Sullivan estimates, global IT outsourcing market is expected to reach US\$ 597 billion growing at a CAGR of 7.2% in the same period.

1.9.3. Global IT Support Services

IT Support Services refers to technical support and maintenance for IT systems – ensuring that end-users and enterprises can use technology smoothly. This includes help desks/service desks that handle user issues, technical support for software and hardware, IT infrastructure support (troubleshooting networks, servers), and maintenance services like system patching and upgrades. It can also extend to training and user education as part of support. Often, IT support is delivered via multi-tier service teams (Level 1 basic help, up to Level 3 expert engineering support). In the industry segmentation, support services sometimes overlap with outsourcing (many companies outsource their helpdesks or hardware maintenance) but it's considered its own segment due to its specialized role of issue resolution and system upkeep.

Post 2020, IT support services had to adapt rapidly to new demands. The pandemic forced a dramatic shift: millions of employees moved to home offices and needed remote IT support for connectivity, devices, and new collaboration software. Support teams rolled out new protocols for remote troubleshooting and massively scaled use of VPNs and video conferencing support. This period also saw a spike in support for cloud-based apps as businesses adopted tools like Zoom, Teams, cloud ERP etc., and needed users to be onboarded and supported remotely. Many organizations turned to external IT support providers or augmented their helpdesks via managed service contracts to handle the surge in tickets from remote workers. By 2022–2023, support volumes stabilized, but expectations had increased – users now demand faster, 24/7 support and often multi-channel assistance (phone, chat, self-service, etc.).

From a market perspective, a significant portion of IT services revenue comes from support and maintenance. Companies worldwide outsource some aspect of customer support or IT helpdesk functions, highlighting that support is frequently entrusted to service vendors. Many hardware / software vendors also provide support services. Overall, the support segment grew in absolute terms, but providers also faced pressure to improve efficiency – leading to widespread introduction of AI and automation in support workflows.

The global IT support services market was valued at US\$ 163 billion in 2020 and grew to reach an estimated US\$ 222 billion by 2024. Looking forward to 2025–2030, as per Frost & Sullivan estimates, global IT outsourcing market is expected to reach US\$ 338 billion growing at a CAGR of 7.3% in the same period.

1.9.4. U.S. IT Services Industry

The United States is the largest and most mature market for IT services globally, accounting for a substantial share of worldwide IT spending and services demand. Through 2020–2025, the U.S. market has mirrored global trends (cloud adoption, digital transformation, etc.) but often leads in early adoption of new technologies and models.

The U.S. economy's scale, combined with its tech-savvy enterprises, make it a bellwether for the IT services industry. U.S. corporations are among the biggest consumers of IT consulting, outsourcing, support, and BPO services.

2020–2025 Overview: The U.S. IT services market saw robust growth during this period, though not without challenges. Early in 2020, the pandemic caused some project delays and IT budget caution. But it quickly became clear that digital tech was critical for resilience, leading to surging demand for services in cloud migration, remote work enablement, e-commerce, and cybersecurity. U.S. enterprises accelerated their digital roadmaps – for example, retailers invested heavily in online channels and supply chain digitization, healthcare providers stood up telehealth and patient portals, banks enhanced online banking and data analytics for risk. All these initiatives required consulting and integration assistance, as well as ongoing managed services.

Exhibit 42: USA IT Services Market (USD Bn) - CY2020 – 2030F
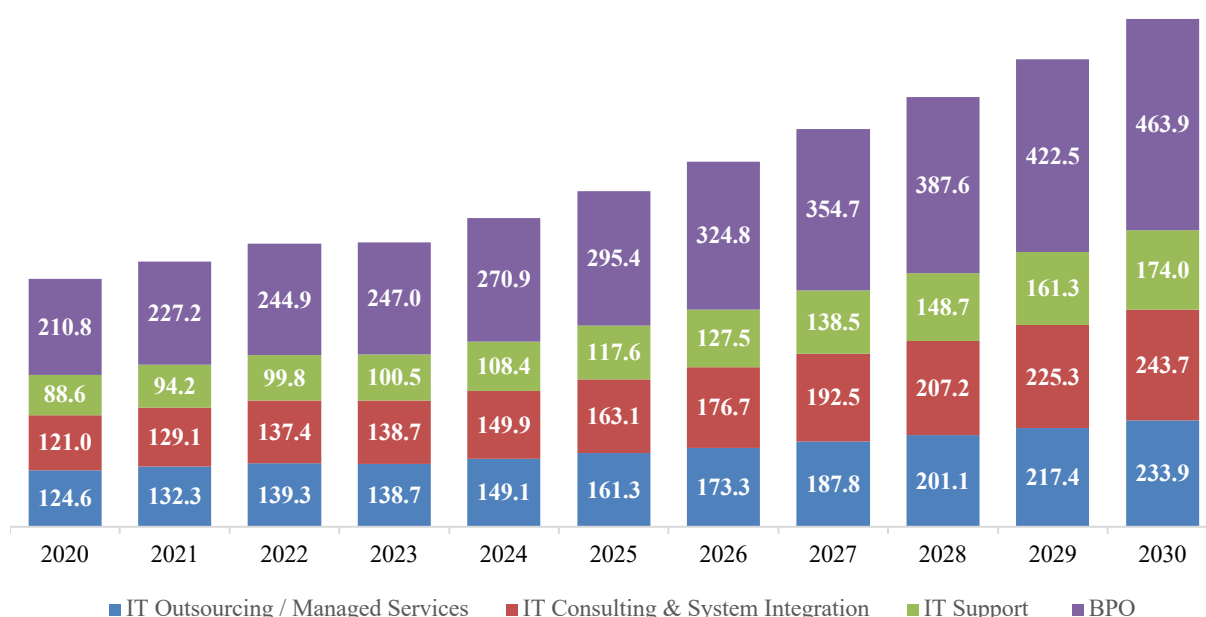
Source: Frost & Sullivan analysis

The US IT Services market was valued at US$ 545 billion in 2020 and grew to reach an estimated US$ 678 billion by 2024. Looking forward to 2025–2030, as per Frost & Sullivan estimates, US IT services market is expected to reach US$ 1,115 billion growing at a CAGR of 8.6% in the same period.

IT spending in the U.S. rebounded strongly by 2021–2022 and has continued to rise. Key drivers in the U.S. included an imperative to modernize aging tech infrastructure (some large enterprises and government agencies run decades-old systems), fierce competition pushing customer-facing innovation, and a heightened cybersecurity threat environment prompting security service investments. Moreover, emerging technologies like blockchain, IoT, and edge computing were also instrumental in driving this growth, powering innovation in finance, manufacturing, healthcare, and logistics. Their ability to enhance efficiency, security, and real-time decision-making is prompting significant investments across public and private sectors. Moreover, U.S. firms have abundant access to capital, especially with interest rate cuts in early 2020s, which helped fund technology initiatives.

A notable feature of the U.S. market is that enterprises here often engage multiple service providers, including the top global firms and niche specialists. The presence of the headquarters of many service giants (Accenture, IBM, Deloitte, etc.) and a vibrant ecosystem of tech startups/consultancies means U.S. clients have many choices. U.S. companies also pioneered the use of hybrid sourcing, blending in-house IT, onshore contractors, nearshore teams (e.g. in Canada or Mexico), and offshore outsourcing to India, Philippines, etc. By 2025, this model has become

standard, with many large U.S. firms maintaining significant offshore captive centers or vendor relationships for cost efficiency.

U.S. Enterprise Priorities: American organizations in this timeframe prioritized:

Exhibit 43: U.S. Enterprise Priorities
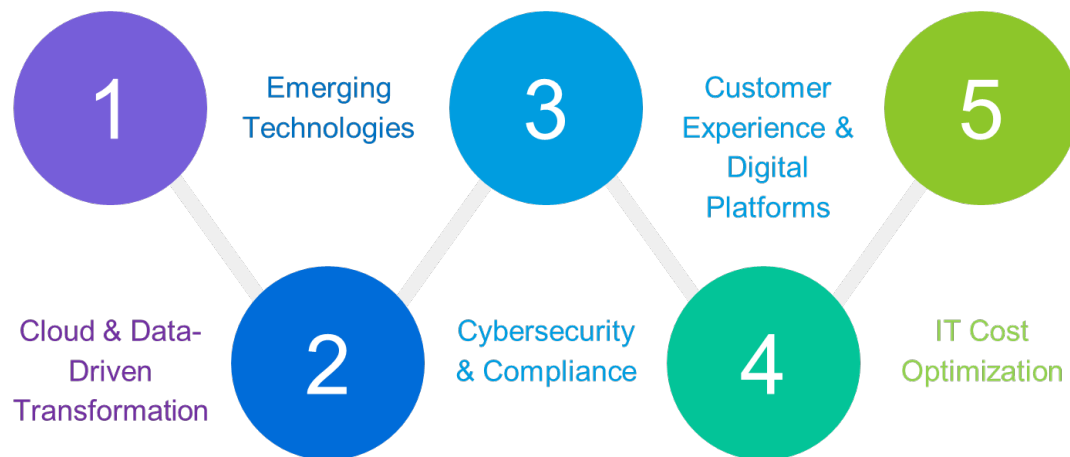
U.S. enterprises prioritized cloud and data-driven transformation, leading with multi-cloud, hybrid strategies, and automation, especially in finance and tech. Spending on emerging technologies accelerated digital transformation and efficiency, while cybersecurity and compliance gained urgency after high-profile breaches and stricter regulations in finance, healthcare, and critical infrastructure. Customer experience investments drove demand for digital platforms, personalization, and omnichannel commerce in retail and media. Simultaneously, IT cost optimization remained central, with outsourcing, managed services, and cloud subscriptions helping firms balance innovation with efficiency. Together, these priorities reinforced U.S. enterprises' global leadership in secure, data-driven, and customer-centric digital growth.

Forward-Looking (2025–2030): The U.S. IT services market is expected to maintain strong growth into 2030, propelled by ongoing digitalization across both private and public sectors:

- Federal and State governments in the U.S. are ramping up modernization (some using big funding packages allocated for IT), which will open many opportunities for IT contractors and consultants (with focus on cloud, cybersecurity, citizen digital services).
- U.S. industries like automotive (with the electric and autonomous vehicle push), manufacturing (Industry 4.0 and IoT adoption), and energy (grid modernization) will increasingly need IT integration and managed services – these represent growth verticals.
- The talent shortage in IT is especially acute in the U.S. given low unemployment in tech fields; this will likely cause even more reliance on outsourcing and staff augmentation from abroad. We might see U.S. companies expanding their own captive centers in places like India or engaging larger outsourced development teams, not just for cost but because they can't hire enough skilled workers locally. For instance, there's huge demand for AI/ML engineers and cloud specialists in the U.S., and providers are bridging that gap.
- Geopolitical and supply chain considerations could influence sourcing: while cost pressures still favor offshoring, there's also a push in some quarters to create U.S.-based IT jobs (for resilience and political support). The balance between offshoring vs onshore/nearshore delivery in U.S. outsourcing will be interesting to watch – already nearshoring to Latin America is on the rise, benefiting from geographic and cultural proximity.
- In terms of spend areas, U.S. companies are expected to heavily invest in advanced analytics, AI solutions (including generative AI enterprise applications), cybersecurity (zero-trust architectures, etc.), and

modernization of legacy core systems (especially in banking, government, healthcare where many older systems still run). Each of these areas requires significant consulting and integration work.

- Sustainability and ESG are becoming important in the U.S. corporate agenda; IT services related to carbon tracking, efficient IT operations (Green IT), and ESG data management may see increased demand from U.S. clients as they work toward climate goals and reporting requirements.

Overall, the U.S. will continue to set the pace for the global IT services sector in many ways. It's often the first to adopt new tech, and service providers frequently pilot new offerings with U.S. clients (who have the budget and appetite for innovation). The expectation is the U.S. IT services market will remain highly competitive and dynamic, with a focus on delivering tangible business outcomes and innovation to clients.

1.9.5.   US IT Consulting & System Integration Market

The U.S. IT consulting and systems integration market is arguably the most developed in the world. American companies are frequently early adopters of new technologies, and they rely heavily on consulting partners for strategy and implementation. The 2020–2025 period saw U.S. enterprises engaging consulting firms for a wide range of transformative projects: migrating core business applications to cloud (e.g., many U.S. banks moving systems to AWS/Azure with consulting help), implementing advanced analytics and AI (retailers using consultants to stand up AI-driven supply chain systems), and modernizing customer-facing systems (telecom and media companies overhauling their digital products). U.S. businesses also undertook large-scale ERP upgrades (such as transitions to SAP S/4HANA or Oracle Cloud ERP), which created plenty of SI work.

The US IT Consulting and system integration market was valued at US$ 121 billion in 2020 and grew to reach an estimated US$ 150 billion by 2024. Looking forward to 2025–2030, as per Frost & Sullivan estimates, US IT Consulting and system integration market is expected to reach US$ 244 billion growing at a CAGR of 8.4% in the same period.

1.9.6.   US IT Outsourcing / Managed Services

The United States has one of the most extensive markets for IT outsourcing / managed services, characterized by both a high adoption rate and a diverse set of delivery models. American companies have been outsourcing IT functions for decades, from the early era of mainframe facilities management to the large offshore application development deals of the 2000s and now to cloud-managed services. In 2020–2025, U.S. organizations continued to outsource heavily, but the nature of outsourcing evolved. Traditional outsourcing (like long-term contracts to run data centers or handle IT support) continued in many legacy-heavy firms, while newer managed services (like managing AWS environments, SaaS operations, cybersecurity monitoring) surged.

A noteworthy trend in the U.S. has been multi-sourcing – instead of awarding all IT outsourcing to one big vendor, companies now often use multiple specialized providers. For example, a U.S. firm might use one provider for infrastructure management, another for applications, and a niche security firm as MSSP. This creates a competitive, segmented landscape. It also demands more vendor management skills on the client side.

The US IT outsourcing market was valued at US$ 125 billion in 2020 and grew to reach an estimated US$ 149 billion by 2024. Looking forward to 2025–2030, as per Frost & Sullivan estimates, US IT outsourcing market is expected to reach US$ 234 billion growing at a CAGR of 7.7% in the same period.

1.9.7.   US IT Support Services

IT support services in the United States encompass a broad range of activities to assist both end-users and IT systems. The U.S. being a highly digitized economy, the scale of support required is enormous – millions of employees, customers, and citizens needing technical help daily. U.S. companies generally aim for high-quality support to ensure productivity and customer satisfaction, and many invest significantly in support infrastructure or outsource to capable providers.

Corporate IT Support: Most medium to large U.S. enterprises maintain an IT helpdesk for their employees. However, the operation of these helpdesks is often outsourced or co-sourced. For example, a common model is a U.S.-based Level 2/3 team (for complex issues and leadership) with a Level 1 helpdesk outsourced to a call center either domestically or offshore. Many U.S. firms outsource night and weekend support coverage to offshore teams

to provide 24/7 service. It's reported that a majority of U.S. enterprises (especially 24x7 operations like global firms) have some portion of IT support handled externally.

Consumer Tech Support: The U.S. also has a significant consumer tech support segment – for instance, telecom companies providing tech support to their customers or PC manufacturers offering support plans. These are often delivered from large contact centers (onshore or offshore). Companies like Apple, for example, have both in-house (AppleCare) and outsourced support for their customers. ISPs and cable companies in the U.S. often contract third-party support firms for tier-1 customer technical support.

During 2020–2025, U.S. support services underwent big changes:

- The mass shift to remote work in 2020 meant corporate IT support had to assist users at home. VPN issues, home Wi-Fi, personal device usage – support teams dealt with these new challenges. Many U.S. companies quickly rolled out remote support tools (like remote desktop control, collaboration troubleshooting guides) and expanded support hours.
- Surge in customer support volume in sectors like e-commerce, online banking, telehealth, etc., put pressure on customer support operations. Many B2C companies had to scale up their support contact centers in 2020–21 to handle new digital customers. This often meant bringing on BPO support partners or accelerating AI chatbot deployment to handle frontline queries.
- AI and Self-Service in U.S.: U.S. consumers are generally open to self-service if it's effective. Companies responded by beefing up online knowledge bases, community forums, and AI-driven FAQs. For internal IT support, many U.S. firms introduced AI virtual assistants in their ITSM (IT Service Management) platforms (like chatbots employees can ask for help with password resets or software install instructions).
- Emphasis on Experience: American companies track metrics like CSAT (customer satisfaction) and employee satisfaction with IT support closely. Tech support is seen as part of overall employee experience. Thus, support services in the U.S. put focus on soft skills, quick resolution, and not just technical closure of tickets. The "shift-left" strategy (solving issues at the lowest possible tier quickly) was widely implemented, meaning more empowerment and knowledge at tier-1 support.

The US IT support services market was valued at US$ 89 billion in 2020 and grew to reach an estimated US$ 108 billion by 2024. Looking forward to 2025–2030, as per Frost & Sullivan estimates, US IT outsourcing market is expected to reach US$ 174 billion growing at a CAGR of 8.2% in the same period.

1.10. Global Artificial Intelligence (AI) Market Overview

Artificial Intelligence (AI) adoption is accelerating as organizations seek transformative gains in efficiency and innovation.

The global AI market is experiencing exponential growth. The global Artificial Intelligence (AI) market was valued at USD 93 billion in 2020. The market is forecasted to be USD 272 Bn in 2025 and is expected to reach USD 1,595 billion by 2030 with a CAGR of 42% over the forecast period (2025-2030).

Exhibit 44: Global, USA and India Market Size (2020 to 2030) , USD Billion

Year	Global	USA	India
2020	93	28	2
2021	202	60	5
2022	125	37	3
2023	138	40	7
2024	186	54	9
2025	272	78	11
2026	396	112	14
2027	579	162	16
2028	812	224	22
2029	1138	311	31
2030	1595	431	44

■ Global ■ USA ■ India
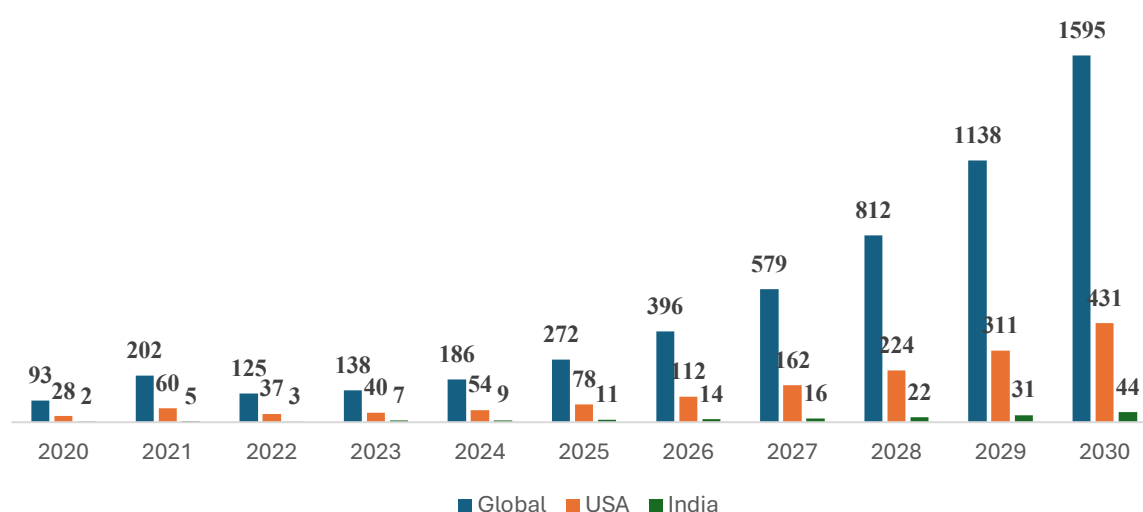
Source: Frost & Sullivan, Secondary Sources

This explosive expansion is underpinned by a confluence of trends that are reshaping industries worldwide:

- Widespread Enterprise AI Adoption: AI has moved from pilots to mainstream use in business. Over three-quarters of organizations globally now use AI in at least one business function, a massive jump from just 55% a year prior , as per '2025 AI Index Report'. Businesses are increasingly integrating AI into their operations and large firms consider AI crucial for maintaining competitiveness. This broad adoption spans applications from customer service chatbots to supply chain optimization, signalling that AI is becoming a standard tool for productivity and decision support.

- Generative AI Revolution: The advent of generative AI (AI that creates new content like text, code, images) marks a pivotal trend. The late-2022 release of OpenAI's ChatGPT unleashed unprecedented interest as within five days it gained over 1 million users, a growth rate far outpacing past tech launches. Generative AI investment and market size have surged: in 2024, generative AI attracted $33.9 billion in private investment globally, up 18.7% from 2023. As per Frost & Sullivan, generative AI market is expected to reach US$ 193 billion by 2030. The growth of this segment at an expected CAGR of 31% (2025 to 2030), is fuelled by companies worldwide who are racing to deploy generative AI for content creation, coding assistance, design, and more.

- Infrastructure and AI Compute Growth: The rise of AI is fueling massive growth in AI-focused infrastructure, particularly cloud computing and specialized hardware. Availability of scalable cloud AI services has lowered entry barriers, enabling even smaller firms globally to train and deploy AI models without owning expensive hardware. Meanwhile, demand for high-performance AI chips (GPUs, TPUs, etc.) is soaring. The data-center GPU market essential for training advanced models ballooned as hyperscale cloud providers and tech giants raced to expand capacity. This unprecedented growth highlights the rush to build the computational backbone for AI. Such infrastructure growth is self-reinforcing: more compute enables more powerful AI models, spurring further adoption.

- Sectoral Adoption Across Industries: AI uptake is occurring across virtually all sectors, though at varying paces. Tech and financial services industries were early leaders for instance, fintech, enterprise software, and banking boast the highest concentration of "AI leader" companies. These sectors leverage AI for algorithmic trading, risk modeling, customer analytics, and product personalization. Telecom and media firms are also heavy adopters (e.g. using AI for network optimization and content recommendations), as are retail and e-commerce (for supply chain and customer experience). Manufacturing and automotive industries increasingly use AI in automation and predictive

maintenance. Even traditionally slower sectors like healthcare, agriculture, and government are embracing AI for diagnostics, smart farming, and public services. In essence, AI is permeating all corners of the economy, though the depth of integration varies - high-tech industries lead in advanced AI deployment, while others are quickly catching up by applying AI to their specific needs.

- Evolving Regulatory Environment: A notable global trend is the growing focus on AI governance and regulation. Policymakers worldwide are grappling with how to balance innovation with oversight on issues like bias, privacy, and safety. Europe is spearheading AI regulation with the forthcoming EU AI Act, aiming to set strict rules on high-risk AI systems and transparency. Other multinational bodies like the OECD, United Nations, and African Union have introduced AI principles around transparency, fairness and accountability. In contrast, approaches vary elsewhere: the United States has favored a lighter-touch, framework-driven approach thus far (e.g. the White House's "AI Bill of Rights" blueprint and NIST's AI Risk Management Framework) rather than hard law, though discussions are intensifying. India and many developing countries are focusing on AI enablement (investing in AI development and skills) with relatively minimal regulation initially, viewing AI as an opportunity for growth. This divergence in regulatory regimes is itself a key trend – global companies must navigate a patchwork of AI rules. Nonetheless, overall regulatory momentum is increasing: international cooperation on AI governance intensified in 2024, with multiple frameworks emerging to guide responsible AI use. For corporate buyers, this means diligence in compliance is increasingly part of the AI adoption equation, especially when operating across borders.

Taken together, the global AI landscape in 2024–25 is one of soaring market growth and fervent innovation, tempered by emerging governance considerations. AI is now embedded in everyday life from enterprise workflows to consumer services, for example, dozens of AI-enabled medical devices have been FDA-approved for healthcare, and autonomous vehicles are providing real rides in cities. Businesses are "all in" on AI, driving record investment and usage as studies continue to show AI can significantly boost productivity. This pervasive adoption, coupled with the generative AI catalyst, robust infrastructure investment, and cross-sector proliferation, define the current global AI market trajectory.

1.10.1. Global AI Market Drivers

Several key drivers are propelling the global AI market forward. These factors underpin the rapid growth and high investor interest, creating a virtuous cycle of technology advancement and business adoption:

- Cloud Computing and Scalable Infrastructure: The maturation of cloud infrastructure is a fundamental enabler of AI's global rise. Affordable, on-demand access to vast computing power and storage has allowed organizations of all sizes to develop and deploy AI without massive upfront capital. Cloud-based AI platforms and AI-as-a-Service offerings have democratized access to machine learning tools and big-data processing. Notably, North America's dominance in AI (32% of global market share in 2024) is attributed in large part to the presence of cloud hyperscalers like Microsoft, Google, and Amazon driving innovation. Their global cloud networks put advanced AI capabilities within reach of enterprises and startups across the world. This cloud ubiquity accelerates AI adoption globally as companies can experiment and scale successful AI solutions quickly. In addition, specialized AI hardware (GPUs, AI chips) is increasingly available through cloud providers, further lowering barriers. As evidence of this driver, governments and firms are heavily investing in AI compute capacity.

- Growth of the Global AI Talent Pool: The expansion of skilled human capital in AI is both a driver and a result of market growth. Over the past few years, there has been a surge in AI education, research, and workforce development programs worldwide. Universities have launched new AI and data science programs, and online courses have upskilled millions of engineers in machine learning techniques. Consequently, the number of AI professionals globally has risen dramatically, fueling innovation and implementation. For example, India alone now has over 600,000 AI professionals, accounting for 16% of the world's AI talent (second only to the US). Other countries from Canada to China are also nurturing large AI talent bases through academic initiatives and incentives to attract researchers. This

growing talent pool enables more organizations to undertake AI projects and drives the creation of AI startups in every region. However, demand still outstrips supply, making top AI expertise highly valuable, a dynamic that is prompting cross-border talent flows and high compensation, which in turn attracts more entrants into the field. For investors, regions with a strong talent pipeline (like the US, India, Canada, UK, etc.) are particularly attractive for AI venture funding and corporate R&D centers.

- Investment Momentum and Capital Infusion: Record levels of investment are pouring into AI globally, creating a powerful flywheel for market expansion. Venture capital funding, private equity, corporate investments, and government grants in AI have all reached all-time highs. Worldwide, tens of billions of VC dollars have backed AI startups annually, and established tech companies have ramped up AI R&D spending. Private investment is augmented by public funding in many countries; for example, the EU and China have multi-billion-dollar AI programs, and the U.S. government's AI R&D budget has been growing steadily. These investments drive rapid progress enabling startups to develop cutting-edge AI solutions and incumbents to integrate AI at scale. Importantly, capital is not only flowing to software algorithms, but also to data ecosystems, specialized hardware, and AI-focused service firms building out the entire value chain. For corporate buyers, this momentum means a plethora of innovative AI solutions are entering the market, and there is competitive pressure to invest in AI internally or via partnerships to not fall behind.

- Strong Enterprise Demand for Automation and Insights: Underlying the above drivers is the demand-pull from enterprises worldwide seeking to harness AI for strategic benefit. Companies are pursuing AI to drive automation, cost savings, improved decision-making, and new revenue opportunities. The pandemic further accelerated digital transformation imperatives, of which AI is a key component. Enterprises now explicitly prioritize AI, not just as a tech experiment but as core to future business models. This has led to the creation of internal AI centers of excellence and significant budget allocations for AI projects in Fortune 500 firms and SMEs alike. Early successes in improving productivity (for instance, AI-assisted coding tools boosting software developer output, or AI analytics cutting supply chain costs) have created demonstrable ROI cases, spurring broader adoption. In short, a growing recognition that AI can boost productivity and growth is fueling a virtuous cycle of enterprise investment. This strategic demand from end-users ensures that the market expansion is sustained by real needs, not just hype.

The global AI market is riding on robust drivers: ubiquitous cloud infrastructure, a rapidly expanding talent and knowledge base, unprecedented capital availability, and strong end-user demand for AI-powered transformation. These drivers reinforce each other, for example, cloud platforms attract more talent to build on them, and investment creates better tools that increase enterprise demand creating a self-sustaining growth trajectory.

1.10.2. USA AI Market Landscape and Key Market Drivers

The United States stands as the world's leading AI market by most measures, underpinned by a mature tech ecosystem and hefty investments. In 2024, the U.S. accounted for the largest share of global AI market size @ 29% of the global market. The USA Artificial Intelligence (AI) market was valued at USD 28 billion in 2020. The market is forecasted to be USD 78 Bn in 2025 and is expected to reach USD 431 billion by 2030 with a CAGR of 41% over the forecast period (2025-2030). North America (driven mainly by the U.S.) held about 32% of the global AI market in 2024. USA's dominance is evident not only in market size but also in its outsized influence on AI trends (e.g. the generative AI boom largely originated from U.S.-based labs and companies).

AI leadership in the U.S. is characterized by a powerful combination of innovation, investment, and adoption:

- The U.S. is home to most of the top AI technology companies and platforms from giants like Google, Microsoft, Amazon, Meta, and IBM to cutting-edge startups like OpenAI and Anthropic. This concentration of AI innovators means many of the groundbreaking AI models and software frameworks are developed in the U.S. (for example, 40 of the world's most notable AI models in 2024 were produced by U.S.-based institutions, far ahead of any other country). This leadership in foundational

R&D gives the U.S. a competitive edge in setting technical standards and capturing early market share in new AI applications.

- The U.S. also far outspends any other country in AI investments. As per '2025AI Index Report', in 2024, U.S. private investment in AI reached $109.1 billion, nearly 12 times the amount invested in China (~$9.3B) and dwarfing that of the next-largest country. American venture capital and tech firms have aggressively funded AI ventures, especially in the wake of the success of generative AI. This capital intensity has fueled a vibrant startup ecosystem; the U.S. consistently launches and funds more AI startups than any other nation. For investors, the U.S. remains the primary hotspot for AI venture opportunities, and for corporate buyers, it means many of the most advanced AI solutions originate from U.S. companies.

- Enterprise adoption in the U.S. is deepening. American companies, particularly large enterprises, have been early adopters of AI to streamline operations and generate insights. Leading sectors include technology, financial services, healthcare, retail, and manufacturing, all witnessing AI-driven transformations such as automated customer service, fraud detection, predictive maintenance, and personalized marketing. The U.S. enterprise market's willingness to invest in AI at scale (often through multi-million-dollar digital transformation projects) significantly contributes to overall demand. Additionally, U.S. corporations are increasingly integrating generative AI into workflows, e.g., using large language models to assist in coding, content generation, and customer interaction.

- Regulatory and policy landscape in flux: While the U.S. does not yet have comprehensive AI-specific legislation akin to the EU, there have been notable regulatory shifts. Federal agencies and the White House have issued guidelines addressing AI ethics, fairness, and risk management. For instance, the Blueprint for an AI Bill of Rights (a guideline issued by the OSTP) and the NIST AI Risk Management Framework (released in 2023) signal initial steps toward governance. In addition, in 2023 the U.S. government convened major AI companies to pledge voluntary commitments on AI safety and transparency. Congress has been actively discussing AI oversight, with various bills proposed around algorithmic accountability and data privacy in AI. At the same time, state-level regulations (such as Illinois' AI video interview law or emerging rules in California for automated decision systems) are beginning to appear. Overall, regulation in the U.S. is still evolving and remains more permissive compared to Europe, a factor that many in industry see as allowing innovation to flourish, though it also means companies must self-regulate to some extent to avoid ethical pitfalls. Corporate buyers in the U.S. thus operate in an environment of watchful self-governance with anticipation of clearer rules to come.

Key drivers in the U.S. AI market mirror the country's strengths in technology and innovation. Some of the primary drivers include:

- Dominance in Cloud and AI Platforms: The U.S. leads in cloud computing infrastructure, which in turn propels AI adoption. American cloud providers not only supply the bulk of global cloud capacity but also offer specialized AI and machine learning services. This gives U.S. businesses early access to cutting-edge AI tools and scalable compute. The presence of these hyperscalers domestically means U.S. AI developers and enterprises enjoy low-latency, high-powered resources to train models and deploy services. Moreover, these cloud firms are continuously innovating (e.g. offering new AI chips, managed MLops platforms), effectively pushing AI capabilities forward. This synergy between cloud and AI in the U.S. is a key market driver.

- Robust R&D Ecosystem (Private + Public): Another driver is the unparalleled R&D environment in the U.S. Leading tech companies invest heavily in AI research, resulting in a steady pipeline of breakthroughs. Simultaneously, the U.S. academic and public research institutions conduct foundational AI research. The U.S. government has increased funding for AI through initiatives like the National AI Research Institutes and the DARPA AI programs. This public-private R&D synergy creates a virtuous cycle: fundamental research ideas often transition into industry applications via startups or

corporate labs, keeping the U.S. on the cutting edge. Being at the forefront of innovation attracts global talent to U.S. institutions as well, reinforcing the cycle.

- Vibrant Startup and Investment Climate: The venture capital network and entrepreneurial culture in the U.S. strongly drive the AI sector. Silicon Valley and other tech hubs have nurtured numerous AI-focused startups in areas from autonomous vehicles to enterprise AI software. Investors have been rewarding bold AI ideas with substantial funding, which enables rapid scaling. The presence of serial entrepreneurs, incubators, and experienced tech investors in the U.S. means new AI ventures can quickly get mentorship and capital. Additionally, a healthy exit environment (through acquisitions by Big Tech or IPOs) further motivates AI entrepreneurship. This climate keeps the U.S. AI market dynamic and continually refreshed with new solutions, a major benefit to corporate buyers looking for innovative tools.

- Public-Private Initiatives and Government Support: The U.S. government, while not as centrally directed in AI as some countries, has launched initiatives that indirectly drive the market. For example, the National AI Initiative Act has coordinated federal efforts and funding in AI; the CHIPS and Science Act of 2022 earmarked significant funds for semiconductor and AI research; and various defense and intelligence agencies invest in AI for national security (which often yields commercial spin-offs). There is also increasing collaboration between government and industry on AI ethics and workforce development (e.g., the AI Talent Expansion program in universities). Such public-private partnerships ensure that critical areas like workforce training, fundamental research, and ethical frameworks are being addressed, which in turn supports sustainable growth of the AI market.

USA's AI market is characterized by its scale and sophistication. For investors, the U.S. offers the largest addressable AI opportunities and a relatively favorable regulatory environment for innovation. Corporate buyers benefit from access to world-leading AI vendors and talent domestically. However, they also face intense competition both for AI talent and in deploying AI effectively, since most competitors are also adopting AI. Going forward, the U.S. is expected to maintain its leadership, especially in pioneering new AI technologies (like next-generation foundation models or AI hardware). The strategic value for businesses is clear: leveraging the U.S. AI ecosystem, whether through partnerships, acquisitions, or internal development can be critical to staying at the cutting edge of AI capabilities.

1.10.3. India AI Market Landscape and Key Market Drivers

India is an emerging powerhouse in the AI domain, with a market that, while smaller in absolute terms than the U.S., is expanding rapidly and holds unique strategic advantages. In the mid-2020s, India's AI market is often described as being at an inflection point: adoption is accelerating across industries, the startup ecosystem is thriving, and the government is heavily promoting AI as a cornerstone of its digital economy future.

India's AI market is currently a fraction of the global total, but it is fast growing. The India Artificial Intelligence (AI) market was valued at USD 2.3 billion in 2020. The market is forecasted to be USD 10.9 Bn in 2025 and is expected to reach USD 43.5 billion by 2030 with a CAGR of 32% over the forecast period (2025-2030). By 2030 and beyond, if current trends continue, India could become one of the top AI markets globally in terms of volume. It's important to note that India's AI market encompasses not only domestic AI software/hardware spending, but also a huge AI services export component, given India's role as a technology service provider to the world.

Several factors shape India's AI landscape and recent trends:

- Thriving AI Ecosystem and Talent Hub: India boasts a massive pool of tech talent, which is increasingly being channelled into AI. The country has over 600,000 AI professionals and constitutes about 16% of the global AI talent, second only to the U.S. Each year, Indian engineering schools and online programs add tens of thousands of AI-skilled graduates. This talent availability has fostered a vibrant startup scene: more than 2,000 AI startups have launched in India in the past three years alone, developing solutions in areas like fintech, healthcare, education, and enterprise software. Cities like Bangalore, Hyderabad, Delhi NCR, and Mumbai are becoming AI innovation hubs, with incubators

and accelerators nurturing new ventures. Indian AI startups are attracting growing investment from both domestic and international investors, given their ability to combine technical prowess with cost-effective development. The large talent pool also means many global companies have set up AI R&D centers in India, tapping local expertise for product development. This ecosystem momentum is a major reason India's AI market is on a steep growth curve.

- Government Programs and Policy Support: The Indian government has made AI a strategic priority, launching multiple initiatives to spur development and adoption. A landmark step is the national IndiaAI Mission, backed by a Rs. 10,000 crore (over $1.2 billion) fund to build AI capabilities. This mission includes establishing a national AI compute infrastructure aiming to provide 10,000+ high-end GPUs for AI researchers and startups via a public-private cloud platform. In fact, by 2025 India is slated to add many new data centers to support digital and AI growth. The government has also invested in digital public infrastructure that underpins AI solutions: for example, India's massive biometric ID system (Aadhaar), digital payment rails (UPI), and initiatives like DigiLocker and ONDC (open commerce network) collectively provide population-scale data and platforms that AI applications can leverage. These serve as foundational rails on which AI-driven services (in fintech, e-commerce, e-governance) can be built at scale. Policy-wise, India released a National AI Strategy ("AI for All") which identifies focus areas (healthcare, agriculture, smart cities, education and smart mobility) and advocates a collaborative approach to develop AI solutions for societal needs. The government is also creating Centers of Excellence in AI at top institutions to foster research and running skilling initiatives. Overall, this proactive stance and funding from the public sector significantly drive the AI market by seeding projects, creating data ecosystems, and reducing the cost of innovation (for instance, startups being able to use government-provided compute resources).

- Enterprise and Sectoral Adoption in India: Indian enterprises, from large IT services companies to traditional conglomerates, are increasingly adopting AI to enhance efficiency and create new offerings. The IT services and consulting sector (a backbone of India's economy) is embedding AI into its operations and client solutions, to automate code generation, customer support, and business process outsourcing. This not only improves productivity but also turns them into global AI service providers, thereby expanding the market. In other industries, adoption is on the rise: banks and fintech firms in India use AI for customer personalization and risk analytics; manufacturing companies deploy AI for predictive maintenance and quality control; retail and e-commerce leverage AI for inventory and recommendation systems (especially with the boom in online shopping). Even agriculture is seeing AI-driven pilot projects (e.g., crop health monitoring via computer vision), and healthcare startups are using AI for diagnostics and telemedicine triage. The prevalence of AI in business in India indicates that domestic demand not just export demand is becoming a significant contributor to market growth.

- Service Delivery and Outsourcing Leadership: A distinctive aspect of India's AI market is its integration with the country's established IT outsourcing industry. India's large IT firms and startups often serve international clients, effectively making India an exporter of AI solutions and services. Many global corporations outsource AI development, data analytics, and software engineering tasks to Indian service providers or captive centers, drawn by the combination of skill and cost efficiency. This means a substantial portion of "AI market" activity in India is project-driven revenue coming from abroad (e.g., an American bank hiring an Indian firm to implement an AI system). As AI demand grows globally, India's service providers are seeing increased deal flow for AI projects, from building AI models to setting up AI-enabled customer support. The country's reputation as the "back office of the world" is evolving into that of an "AI factory for the world," where complex AI solutions (like machine learning model development, data labeling, etc.) are delivered out of India. This dynamics greatly drives the Indian AI sector's growth and is attractive for investors, as Indian companies can earn in global markets.

- Cost Advantages and Big Data Scale: India offers a cost-competitive environment for AI development, which acts as a driver by attracting projects and experimentation. The cost of AI talent in India is

generally lower than in Western markets (though rising), allowing companies to do more R&D for each dollar invested. This encourages both multinational companies to base AI units in India and local startups to iterate rapidly. Furthermore, India's massive population of 1.4+ billion and the fast-growing digital user base (over 700 million internet users) generate huge volumes of data. This abundance of data, the "fuel" for AI models, provides an edge in training robust AI systems, whether for speech recognition in dozens of Indian languages or analyzing consumer behavior. For instance, the scale of UPI digital payment data or e-commerce transactions in India can help companies train AI for fraud detection or recommendation engines at a scale matched only by China and the US. Thus, India's demographic and usage scale is an intrinsic driver that strengthens AI development locally.

Key drivers in India's AI market are as follows:

- Abundant Talent and Skills Base: India's large pool of engineers and data scientists is a primary driver. The fact that India produces a significant share of the world's AI talent (16%) means that both multinational and domestic firms can find the expertise needed for AI projects in India.

- Government Vision and Investment: The strategic push by the government via funding (e.g., the $1.2B IndiaAI fund), policies like Digital India, and infrastructure projects (AI parks, high-performance compute centers) significantly propels the market. For instance, the planned provision of 18,000 state-of-the-art GPUs for AI development in India, announced in early 2025, will dramatically increase researchers' and startups' ability to train AI models domestically. Such support lowers entry barriers and encourages innovation. Moreover, government-led applications (like using AI in governance, public services, or defense) are creating flagship projects that demonstrate AI value, stimulating further adoption in private sector by example.

- Growing Domestic Market Demand: India's own corporations and consumers are increasingly demanding AI-driven products and services. This includes AI in customer experience (chatbots in banking or telecom customer service are now common), personalization in media (streaming services in India use AI for recommendations), and Industry 4.0 initiatives in manufacturing. As awareness of AI's benefits grows among Indian business leaders, more sectors are piloting AI, even traditional ones like textiles or logistics. The sheer scale of the Indian market means that even pilot projects can involve millions of users, allowing rapid scaling if successful. Sectors like finance and healthcare in India are poised for AI-fueled transformation. This rising domestic uptake ensures that the AI market isn't solely reliant on exports; local revenues are climbing, drawing more investors and entrants into the fray.

- Integration with Global Value Chains: India's role in global tech and services also drives its AI market. Indian firms are often partnering with Western companies as implementation partners for AI solutions. Conversely, global tech companies see India as a key growth market and are tailoring AI products for India or setting up AI research teams there. This two-way integration means India is embedded in the global AI development network, gaining access to the latest technologies and also contributing significantly. Being part of global AI value chains brings investments, skills and market opportunities that accelerate India's AI industry development.

India's AI market is marked by high growth momentum, fuelled by talent and cost advantages, strong government backing, and a dual orientation toward serving both domestic needs and global demand.

1.11. IoT Market Analysis: Global Market Outlook

The Internet of Things (IoT) market has grown rapidly over the past few years and is at a multi-billion dollar scale now, reflecting widespread adoption across industries. This is projected to grow to US$2 trillion by 2030, with a CAGR of about 12.4% from 2025 until 2030. Out of the total market potential, the consumer IOT market was US$ 209 billion in 2020, and is estimated to be US$ 349 billion by 2025 and US$ 625 billion by 2030. Similarly, non-consumer / commercial IOT was US$ 553 billion in 2020, and is estimated to be US$ 919 billion by 2025 and US$ 1,649 billion by 2030.

Exhibit 45: Global IOT Market, Split across Consumer and Commercial IOT, (USD Bn) - CY2020 – 2030F
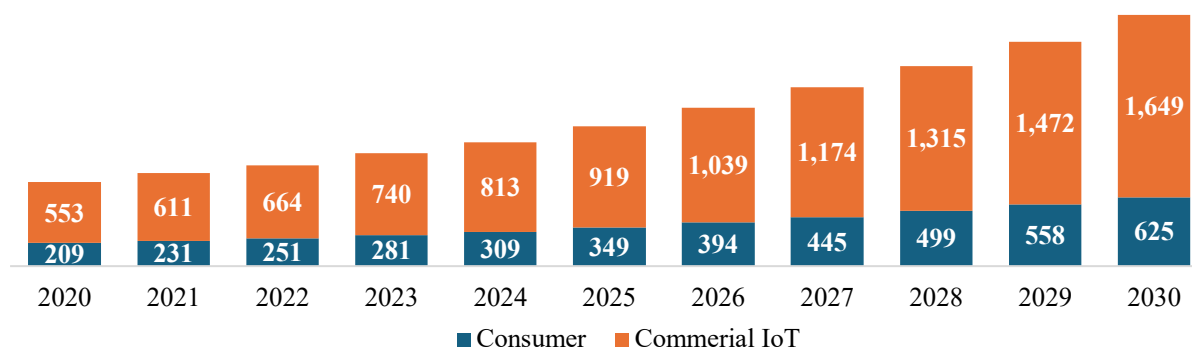
Source: Frost & Sullivan analysis

Growth is driven by increasing deployment of IoT devices (estimated to be about 56 billion connected devices worldwide by 2025) and the need for digital transformation in businesses. Key industries like manufacturing, utilities (energy), transportation, and retail are leading IoT investment, while emerging applications in smart cities and infrastructure are accelerating. Advancements in 5G connectivity, cloud/edge computing, and AI analytics are enabling more sophisticated IoT use cases, and IoT services (integration, data analytics) are becoming a major portion of spending. However, organizations face challenges in scaling pilots to full deployments and must address interoperability and security concerns. Market drivers include declining sensor costs, demand for operational efficiency, and government initiatives (e.g. national smart city programs), which together create significant opportunities for IoT solution providers. The IoT ecosystem involves diverse stakeholders – from device and sensor manufacturers to connectivity providers, cloud platforms, and end-user enterprises – collaborating to deliver end-to-end solutions.

This growth is underpinned by widespread adoption across diverse industries, as organizations connect assets, devices, and processes to drive efficiency and innovation. By the end of 2023 there were roughly 41.7 billion IoT devices in use globally, and this is estimated to reach 56.4 billion devices by 2025 – a testament to how ubiquitous connected devices are becoming. The IoT market encompasses hardware (devices/sensors), connectivity, software platforms, and services. Notably, hardware still constitutes the largest portion of revenues, given the immense volume of devices and sensors being deployed. However, IoT services and software are fast-growing segments, as enterprises invest in systems integration, data analytics, and cloud platforms to make sense of IoT data.

Geographically, the market landscape shows North America and Asia-Pacific as pivotal regions. North America is the single largest IoT market, accounting for more than 33% of global IoT revenues. This is driven by the U.S. (the world's leading national market) which alone constitutes the majority (90%+) of North American IoT spending. Asia-Pacific is catching up fast – it's identified as the fastest-growing region for IoT, fueled by major deployments in China, India, and other rapidly urbanizing economies. Europe is also a significant market with extensive industrial and smart city investments. By 2030, emerging markets (especially China) will substantially increase their share of IoT spending. Overall, developed economies still represent the bulk of IoT spending today (over half of global IoT spend) but the balance is gradually shifting as developing regions ramp up IoT adoption.

From an industry perspective, commercial / industrial IoT dominates the landscape (as opposed to consumer IoT). It is estimated that about 67% of IoT's economic value today as well as in 2030 will come from B2B applications – in factories, cities, offices, supply chains, etc. The manufacturing sector (including both discrete manufacturing and process industries) is one of the most significant sector for IoT deployments by spending. Manufacturers are using IoT for things like operations automation, equipment monitoring, and supply chain optimization. Following manufacturing, other major IoT sectors are utilities/energy, transportation, and retail. For example, electric utilities worldwide have been rolling out smart meters and grid sensors, and oil & gas companies deploy IoT for pipeline monitoring. Retailers use IoT for inventory intelligence and asset tracking. The government and public sector (e.g. smart cities, smart infrastructure) is another area seeing fast growth. The global IoT market as of 2025 is large and diverse, with North America leading in current expenditure, Asia Pacific leading in growth, and industrial applications leading in value.

1.11.1. Key Trends Shaping the Global IoT Market

The IoT domain is evolving rapidly. Several key **technology and market trends** are influencing how the IoT landscape develops globally:

Exhibit 46: Key Trends for Global IoT Market
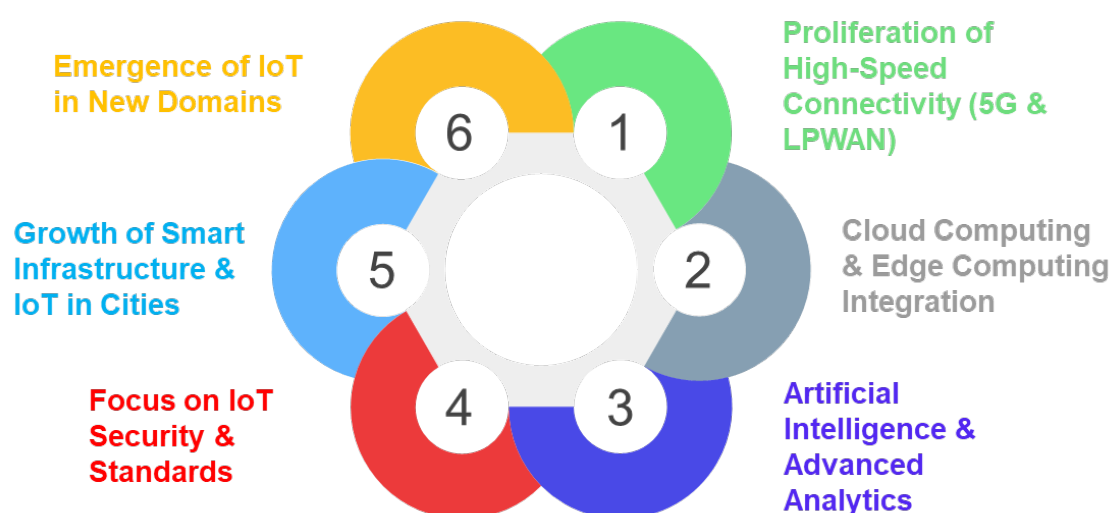
- **Proliferation of High-Speed Connectivity (5G and LPWAN):** The global rollout of **5G** is transforming IoT by enabling real-time, high-volume data transmission with ultra-low latency—essential for advanced use cases like autonomous vehicles, robotics, and smart cities. 5G supports massive machine-type communication, scaling to millions of devices per km². In parallel, LPWAN technologies (e.g., NB-IoT, LTE-M, LoRaWAN, Sigfox) offer low-power, long-range, and cost-effective connectivity for low-data applications like agriculture sensors and remote trackers. Together, 5G and LPWAN are accelerating IoT adoption across both high- and low-bandwidth scenarios.
- **Cloud Computing and Edge Computing Integration:** Modern IoT solutions increasingly rely on cloud platforms (like AWS, Azure, Google Cloud) for scalable data storage, analytics, and remote device management. At the same time, edge computing has emerged as a key complement—processing data locally on devices or gateways to reduce latency and bandwidth use. In scenarios like smart buildings or industrial automation, edge devices can analyze sensor data and trigger immediate actions without waiting for cloud input. Most IoT architectures today follow a hybrid cloud-edge model, supported by IoT gateways that connect legacy systems to the cloud. This integration enables faster, more scalable, and reliable IoT deployments.
- **Artificial Intelligence and Advanced Analytics:** AI and IoT are increasingly intertwined, with AI/ML algorithms unlocking the value of raw IoT sensor data. This enables predictive and autonomous capabilities—such as forecasting equipment failures (predictive maintenance) or analyzing CCTV feeds

for security threats. AI transforms IoT from simple monitoring to intelligent action, shifting operations from reactive to proactive. Many IoT platforms now offer built-in AI tools, often cloud-based, that process data and trigger automated decisions. From manufacturing optimization to health monitoring via wearables, AI is essential for scaling and extracting insights from massive IoT datasets. As algorithms and computing power advance, AI will play an even greater role in enabling smart, data-driven IoT applications.

- **Focus on IoT Security and Standards:** As connected devices proliferate, security has become a top priority in the IoT market. High-profile breaches—like hacked cameras or botnets—have exposed vulnerabilities in IoT networks. In response, manufacturers and users are adopting encryption, strong authentication, and even blockchain for device identity and data integrity. AI-powered threat detection is also emerging to monitor IoT traffic, as traditional IT security tools often fall short. On the regulatory front, governments are introducing cybersecurity requirements for IoT devices, especially in critical infrastructure. At the same time, interoperability standards are gaining traction to overcome fragmentation in protocols. Initiatives like ISO/IEC standards and the Matter protocol aim to ensure cross-vendor device compatibility—key for unlocking large-scale IoT adoption. Together, stronger security and standardized frameworks are building the trust needed for IoT to scale, especially in sensitive sectors like healthcare and finance.

- **Growth of Smart Infrastructure and IoT in Cities:** Cities worldwide are increasingly adopting IoT as the backbone of smart infrastructure, aiming to improve urban services and sustainability. Applications include smart traffic systems, adaptive street lighting, connected waste bins, air quality sensors, and public safety networks. Initiatives like India's 100 Smart Cities Mission are driving large-scale deployment of sensors and connected systems. These projects not only expand IoT device adoption across streets, utilities, and public spaces but also generate valuable data for real-time urban management. Growth areas include smart utilities (energy, water), smart mobility (parking, public transit), and smart buildings integrated into city networks. As cities report benefits like lower energy use, less congestion, and improved safety, smart city models are being replicated globally—fueling public sector–driven IoT market growth.

- **Emergence of IoT in New Domains:** IoT is rapidly expanding into new sectors beyond its early industrial and consumer applications. Emerging areas include healthcare (remote monitoring, smart devices), agriculture (soil sensors, livestock tracking), and financial services (usage-based insurance). The rise of digital twins enables real-time simulation in manufacturing and city planning, while the pandemic accelerated adoption in supply chains and smart buildings. Businesses are also exploring data monetization through insights-as-a-service and data marketplaces. This ongoing diversification is driving sustained IoT market growth and innovation across industries.

Key Stakeholders in the IoT Ecosystem

The IoT market's complexity is reflected in its ecosystem of stakeholders, each playing specific roles in delivering IoT solutions. Understanding the stakeholder landscape is part of the market overview:

- **Device & Sensor Manufacturers:** These players produce the physical building blocks of IoT – from basic sensors to smart meters and embedded communication chipsets. They drive hardware innovation and enable OEMs to embed IoT capabilities into appliances, vehicles, and industrial machinery.

- **Connectivity Providers:** This group includes telecom operators and network infrastructure vendors that supply and operate IoT connectivity via 4G/5G, LPWAN, satellite, and Wi-Fi. Their role is vital in ensuring secure, scalable, and reliable data transmission between devices and platforms.

- **Cloud & Platform Providers:** Dominated by players like AWS, Azure, and Google Cloud, these providers offer IoT platforms that manage devices, process data, and support analytics. They enable integration with enterprise systems and serve as the control and intelligence layer for IoT operations.

- **Systems Integrators & Solution Providers:** These stakeholders customize and deploy IoT systems tailored to clients' needs. They connect hardware, networks, and cloud platforms with enterprise IT (e.g., ERP, analytics), and are essential for scaling complex or legacy-heavy industrial deployments.

- **End-User Organizations:** Businesses and governments deploying IoT are key market shapers. Their priorities—such as ROI, security, and ease of use—influence solution design. Sectors include manufacturing, energy, retail, logistics, healthcare, and smart cities.

- **Regulators & Standards Bodies:** These entities set rules and frameworks around safety, security, data privacy, and interoperability. Bodies like IEEE and oneM2M also promote best practices. Regulatory support (e.g., smart meter mandates) often accelerates adoption.

Collaboration is crucial in this ecosystem: a smart city project, for instance, may involve device makers, telecom operators, cloud platforms, integrators, end-user governments, and regulators. The evolution of IoT hinges on synergy across these stakeholder groups.

Market Drivers and Opportunities

The rapid growth of the IoT market is fueled by multiple **market drivers** – factors that create demand for IoT solutions – and there are abundant **opportunities** for further expansion. Below, we detail the main drivers and emerging opportunities influencing global IoT market growth:

1. Declining IoT Hardware & Connectivity Costs

Falling prices for sensors, connectivity modules, and cloud computing have made IoT adoption more affordable. This enables large-scale deployments across industries and promotes a cycle of higher adoption and further cost reduction.

2. Demand for Operational Efficiency

Organizations worldwide are leveraging IoT to enhance productivity and reduce costs. Applications include predictive maintenance in manufacturing, real-time asset tracking in logistics, and energy optimization in utilities. IoT has become a core part of digital transformation strategies.

3. Government-Led Smart Infrastructure Investments

Governments are major IoT drivers through smart city programs, utility mandates (like smart meters), defense applications, and Industry 4.0 incentives. These initiatives not only generate large-scale demand but also foster a favorable adoption environment.

4. Advances in AI, Cloud, and Edge Computing

The evolution of supporting technologies like AI and cloud platforms enhances the value of IoT. These tools enable predictive analytics, automated decision-making, and large-scale data handling, making IoT implementations more effective and accessible.

5. Expanding Use Cases and Business Models

IoT is unlocking new business models such as usage-based insurance, smart retail analytics, and precision agriculture. OEMs increasingly embed IoT in products to offer value-added services like remote diagnostics and performance-based billing. These developments are creating new revenue streams and market entrants.

6. Sustainability and ESG Mandates

IoT supports energy efficiency, emissions tracking, and worker safety—key pillars of corporate sustainability and ESG goals. Smart buildings, smart grids, and industrial IoT solutions are increasingly adopted to meet carbon reduction targets and green certifications, positioning IoT as a tool for environmental and social impact.

Global IoT growth is driven by falling costs, strong ROI through efficiency gains, tech synergies with AI/cloud, supportive government policies, new business models, and sustainability mandates. These interlinked factors ensure that IoT will remain a dynamic and opportunity-rich tech domain through 2030.

1.11.2. IOT Market Split by Segments

Exhibit 47: Global Non Consumer IOT Market, Split across Segments, (USD Bn) - CY2020 – 2030F

Technology Category	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
■ Software	111	122	129	140	153	170	190	213	236	265	296
■ Services	44	50	56	63	71	81	92	105	118	132	148
■ Security	3	3	4	4	4	5	5	6	7	7	8
■ SaaS	32	36	41	48	56	66	77	90	102	115	128
■ PaaS	11	12	15	19	23	28	34	41	48	54	60
■ Infrastructure	52	59	65	74	83	96	111	130	148	166	186
■ IaaS	3	3	4	4	5	6	7	9	11	12	14
■ End points	242	266	287	316	344	386	433	483	539	603	676
■ Connectivity	55	60	65	71	75	82	89	97	106	119	133
■ Technology Category	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

Source: Frost & Sullivan analysis

The Internet of Things (IoT) market is expanding rapidly across all layers of the technology stack. As per Frost & Sullivan, global non consumer IoT will more than double from around US$ 553 billion in 2020 to US$ 1.65 trillion by 2030. This growth is underpinned by explosive proliferation of connected devices and key technological drivers – including the rollout of 5G networks, cheaper sensors, cloud/edge computing advances, and AI/analytics integration into IoT solutions.

IoT Software

The IoT software segment (including IoT applications and platform software) is one of the fastest-growing areas. It was roughly $111 billion in 2020 is projected around $170 billion in 2025, and $296 billion by 2030, implying a CAGR of approximately 11.8% (2025–30). This robust growth reflects software's pivotal role in deriving value from IoT data. Notably, IoT software growth is outpacing overall IoT spending as organizations invest in platforms and analytics to manage their expanding device fleets. Key drivers and trends include:

Exhibit 48: Drivers & Trends for IoT Software Market
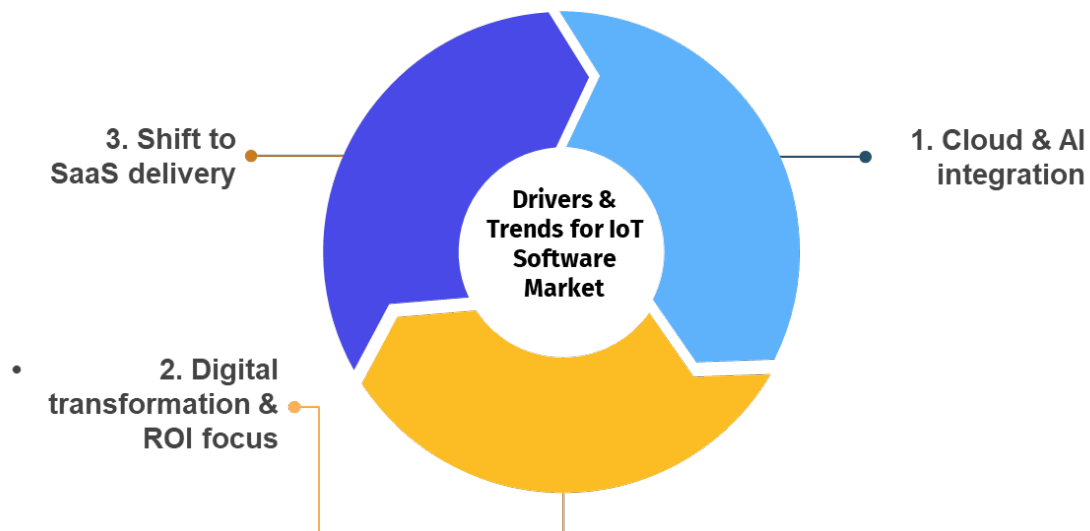
- Cloud & AI integration: All subcategories of IoT software – from IoT platforms (often delivered as PaaS) to infrastructure-as-a-service (IaaS) and IoT applications (SaaS) – are expanding strongly through the decade. Integration of AI/ML is a major catalyst, enabling advanced analytics, predictive insights, and automation within IoT software. This "AIoT" convergence enhances real-time monitoring and decision-making, boosting the appeal of IoT platforms. For example, embedding AI for predictive maintenance or anomaly detection in IoT applications is becoming a standard, driving higher software adoption.
- Digital transformation & ROI focus: Enterprises increasingly recognize IoT software as critical to digital transformation outcomes. IoT platforms and middleware tie together devices, networks, and data, allowing organizations to generate actionable insights (e.g. operational dashboards, digital twins). As more IoT projects move from pilots to scale, demand rises for scalable software solutions to handle device management, data ingestion, storage, and analytics. These software tools enable cost savings and new services, which in turn justify further IoT investment.
- Shift to SaaS delivery: There is a notable shift from custom on-premise solutions to cloud-based IoT software-as-a-service. Businesses favor SaaS IoT applications for their faster deployment, lower maintenance burden, and easy scalability. Major IoT platform providers (AWS IoT, Azure IoT, etc.) now offer end-to-end managed IoT suites, lowering barriers for adoption. This trend reflects a broader industry move to subscription-based IoT software, aligning with IT spending patterns and OPEX preferences. It also lets smaller firms implement IoT solutions without heavy upfront investment.

IoT software is on a strong upswing globally. Platforms, analytics software, and IoT applications are essential enablers as organizations connect more assets. Excitement around AI-driven IoT capabilities and the convenience of cloud-based delivery will continue to make software a fast-growing IoT segment through 2030.

IoT Services

The services segment of IoT – spanning system integration, consulting, deployment and managed services – was about $44 billion in 2024 rising to roughly $81 billion in 2025 and an expected $148 billion in 2030 (approximately 12.8% CAGR from 2025 to 2030). Services form the "glue" that helps diverse IoT components work together, and their growth is driven by the complexity of IoT projects. Key drivers, trends include:

Exhibit 49: Drivers & Trends for IoT Services Market

4. Ecosystem & Support from Cloud Providers

1. Integration & Complexity

3. Use Cases across Industries

2. IoT Deployment at Scale

Drivers & Trends for IoT Services Market

- Integration & complexity: IoT solutions often involve many components (devices, connectivity, cloud, analytics). The increasing complexity of IoT deployments – including integrating AI, 5G, and advanced analytics – is driving demand for expert support. Enterprises typically rely on IoT system integrators and professional services firms to design architectures, implement IoT platforms, retrofit legacy systems, and ensure end-to-end security.
- IoT deployment at scale: As IoT projects transition from pilots to large-scale rollouts, managed services and ongoing support become crucial. Many organizations lack in-house IoT expertise, so they outsource device management, data integration, and analytics support to specialists. For example, a manufacturer implementing thousands of IoT sensors may engage a service provider for 24/7 device monitoring, data visualization dashboards, and maintenance alerts. This trend is accelerating as industries with limited IT staff (like traditional manufacturing, agriculture) adopt IoT. Vendors offering end-to-end IoT "as a service" solutions (bundling devices, connectivity, and monitoring) are gaining traction, effectively turning IoT into an outsourced service for clients.
- Use cases across industries: IoT services are in demand across virtually every vertical. Common use cases driving services growth include smart factory implementations (integrators setting up connected production lines and linking OT data to IT systems), smart city projects (consultants orchestrating sensors, networks, and data platforms for urban services), and logistics/supply chain visibility solutions (deploying asset trackers and integrating data streams). Each of these requires tailoring IoT to existing business processes – a role filled by professional service providers. As IoT adoption broadens, service providers are expanding industry-specific offerings (e.g. IoT for utilities or healthcare) to meet specialized needs.
- Ecosystem and support from cloud providers: Notably, the big cloud players (hyperscalers) are heavily involved in IoT service enablement. They have built extensive partner ecosystems of IoT consulting and integration firms, and often co-sell services. In fact, hyperscalers like AWS, Microsoft, and Google act as the "backbone of IoT" by enabling communication services, industry-specific solutions, and digital twin capabilities in their IoT clouds. This close collaboration is accelerating IoT projects – enterprises can adopt a cloud IoT platform and quickly find certified integration partners to customize and deploy it.

IoT services are critical to realize IoT's value, ensuring that disparate devices and systems can be successfully implemented and managed at scale. The steady double-digit growth of this segment reflects IoT's maturation – moving from experimentation to full production deployments – and the continued reliance on external expertise to navigate IoT's technical challenges.

IoT Security

Security is a smaller but vital segment of the IoT market. In 2020, IoT-specific security spending was only around $3 billion, growing to roughly $5 billion in 2025 and about $8 billion by 2030 (~11.4% CAGR from 2025 to 2030). While relatively modest in revenue, IoT security is experiencing accelerating demand as the proliferation of devices raises serious cybersecurity concerns. Key drivers, trends, and adoption shifts include:

Exhibit 50: Drivers & Trends for IoT Security Market

- Surge in Cyber Threats: Billions of cyberattacks have targeted IoT endpoints like cameras and sensors, often due to weak credentials or unpatched firmware. As a result, security solutions such as authentication systems, encryption, and intrusion detection are now critical for any major IoT deployment.
- Regulatory Push: Governments are mandating stronger device-level protections. California, for instance, requires unique passwords on all IoT devices; similar initiatives exist in the UK and EU. These laws compel manufacturers to adopt secure-by-design practices and drive demand for credential management and OTA (over-the-air) update services.
- Security-as-a-Service Adoption: Organizations, facing a talent shortage in cybersecurity, increasingly outsource IoT protection. Managed security services now offer real-time threat detection, firmware updates, and analytics, enabling even smaller firms to secure their networks effectively.
- Shift to Integrated Platforms: Companies are moving from standalone tools to holistic platforms covering everything from device authentication to cloud-based behavior analytics. Trusted hardware elements (e.g., secure chips) are being embedded into devices and integrated with cloud services, providing end-to-end, hardware-rooted protection.

Overall, securing IoT ecosystems has become a top priority as the stakes (and potential impacts of attacks) grow. The rapid growth of connected devices and networks, coupled with escalating cyberattacks, is directly driving IoT security market expansion. Going forward, we can expect shifting adoption patterns – from reactive spending (after incidents) to more proactive investment in built-in security at the project planning stage. Enhanced regulations and heightened awareness mean IoT security will increasingly be "baked in" rather than bolted on, fueling consistent growth in this segment through 2030.

IoT SaaS (Software-as-a-Service)

IoT SaaS refers to cloud-based IoT software applications delivered on a subscription basis – for example, IoT device management platforms, analytics dashboards, or industry-specific IoT solutions offered as a service. This segment was roughly $32 billion in 2020, rising to about $66 billion in 2025 and an estimated $128 billion in 2030 (approximately 14.2% CAGR over 2025–30). It represents a significant shift in how IoT software is consumed, and it's one of the fastest-growing sub-segments. Key factors and trends include:

Exhibit 51: Factors & Trends for IoT SaaS Market
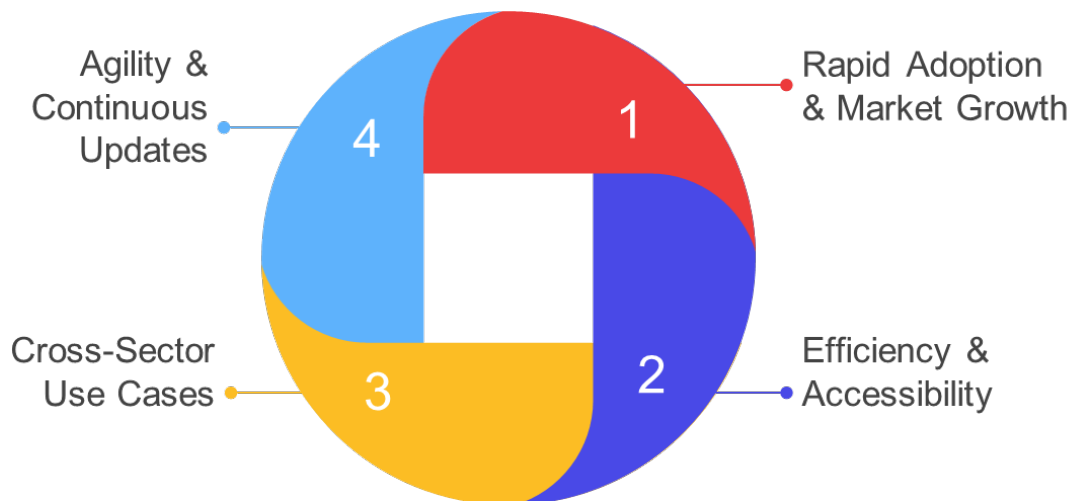
- Rapid Adoption & Market Growth: Businesses are increasingly turning to IoT SaaS platforms to avoid the complexity of on-premise deployments. These cloud-based solutions offer plug-and-play analytics, monitoring, and automation without heavy infrastructure investment.
- Efficiency & Accessibility: SaaS enables faster deployment and lower upfront costs, especially benefiting SMEs. With minimal IT setup, companies can quickly access real-time analytics, alerts, and predictive insights—boosting efficiency and customer experience.
- Cross-Sector Use Cases: IoT SaaS is gaining traction across industries: manufacturers use it for predictive maintenance, healthcare providers for remote patient monitoring, and logistics firms for fleet optimization. These prebuilt solutions save development time while delivering tailored value.
- Agility & Continuous Updates: Cloud delivery allows rapid rollout of new features—such as AI upgrades or regulatory compliance updates—ensuring customers always benefit from the latest functionality. This adaptability strengthens the shift toward SaaS in the IoT ecosystem.

IoT SaaS is transforming how organizations implement IoT, making sophisticated capabilities available on-demand via the cloud. With businesses prioritizing agility and ROI, the SaaS delivery model is expected to continue its robust growth – playing a large role in IoT market expansion through 2030. We are likely to see even more specialized IoT SaaS products (for specific verticals or use cases) and deeper integration of advanced analytics and AI in these cloud platforms.

IoT PaaS (Platform-as-a-Service)

IoT PaaS denotes cloud-based IoT platforms – services that provide the underlying infrastructure and tools for building and managing IoT applications. This includes IoT application enablement platforms, device management platforms, and data management/analytics platforms offered as a service. In 2020, the IoT PaaS market was about $11 billion, growing to roughly $28 billion in 2025 and an estimated $60 billion in 2030 (~16.2% CAGR from 2025 to 2030). Key insights for this segment:

Exhibit 52: Key Insights for IoT PaaS Market
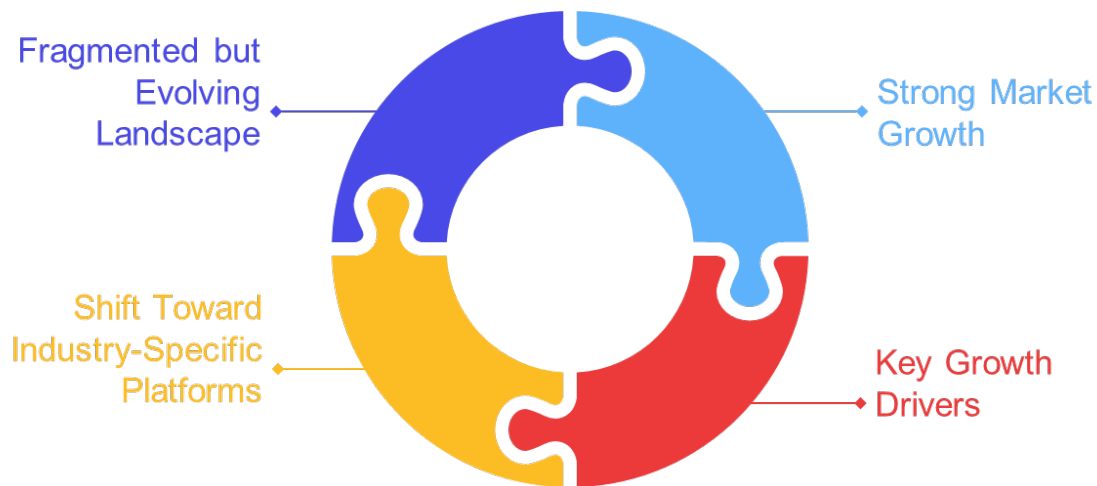
- Strong Market Growth: Driven by widespread IoT deployments and the need for centralized management, connectivity, and data analytics.
- Key Growth Drivers: The expansion of 5G and LPWAN networks, plus integration with AI/ML and edge computing, enhances real-time processing and reduces latency. Modern platforms now support hybrid architectures (cloud + edge) and offer seamless integration with enterprise IT systems (ERP, CRM), amplifying their business value.
- Shift Toward Industry-Specific Platforms: PaaS providers are increasingly targeting verticals like industrial IoT, smart buildings, and agriculture, offering pre-built modules and templates tailored to each sector. This reduces deployment complexity and accelerates adoption.
- Fragmented but Evolving Landscape: The market remains fragmented, with major cloud vendors (AWS, Azure, Google Cloud) leading in general-purpose platforms, while niche players serve specialized needs. Interoperability challenges persist, though gradual consolidation and standardization are underway.

IoT PaaS is critical for enabling scalable IoT solutions, providing the building blocks (device connectivity, data storage, processing, etc.) in a cloud-based model. The segment's strong growth reflects enterprises' needs for reliable, ready-made platforms to accelerate their IoT initiatives. Continued investments in PaaS capabilities – especially around integration, analytics, and edge support – will further solidify this segment's growth through 2030.

IoT Infrastructure

In the IoT context, infrastructure typically refers to the hardware and equipment that support IoT deployments beyond the end devices. This includes things like gateways, routers, edge computing servers, and other on-premise or network infrastructure required to collect, route, and process IoT data. The IoT infrastructure segment was about $52 billion in 2020, rising to roughly $96 billion by 2025 and projected around $186 billion in 2030 (~14.1% CAGR). Growth in this segment corresponds to the physical build-out needed for IoT at scale. Key points and trends:

Exhibit 53: Key Points & Trends for IoT Infrastructure Market
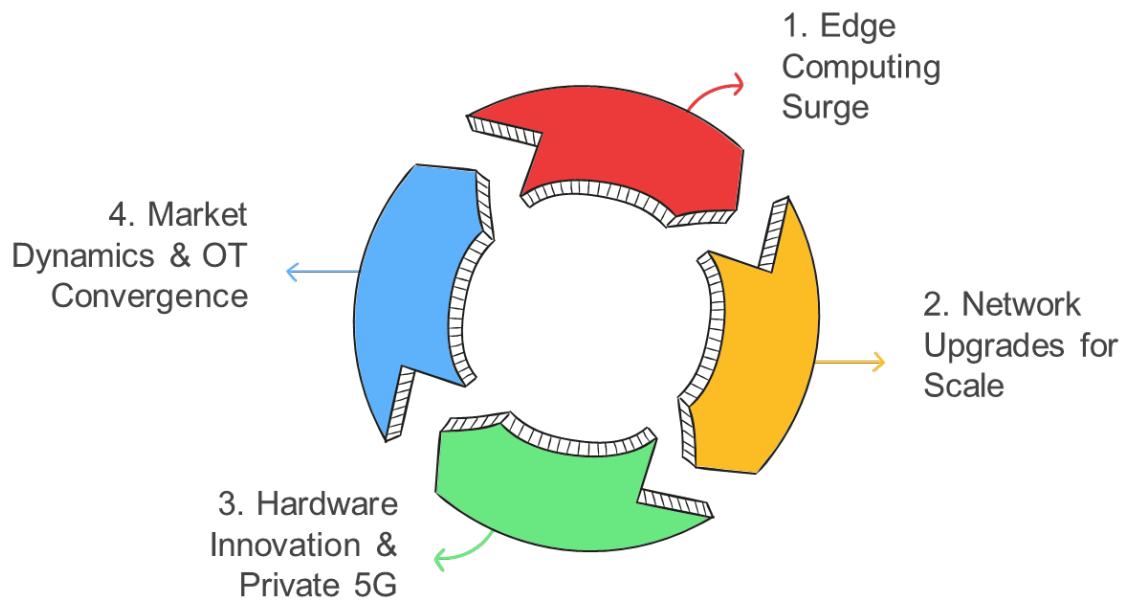
- Edge Computing Surge: The growing demand for low-latency, on-site data processing is driving investment in AI-capable edge infrastructure (e.g., gateways, servers, micro data centers). This supports real-time applications like defect detection in manufacturing and boosts IoT infrastructure spending—especially as 5G and AI adoption expand.
- Network Upgrades for Scale: Enterprises and governments are upgrading networks with more access points, routers, and fiber backhaul to support large-scale IoT rollouts—such as smart cities, agriculture, and industrial facilities. Reliable, wide-area connectivity is key to handling the rising number of connected devices.
- Hardware Innovation & Private 5G: Modern gateways now offer built-in security, multi-protocol support, and modularity. A major trend is the rise of private 5G networks, which require dedicated radios and core equipment—essential for latency-sensitive industrial IoT use cases (e.g., autonomous robots).
- Market Dynamics & OT Convergence: Although recent years saw temporary dips in hardware demand due to supply chain issues, long-term growth is strong. Additionally, the line between IT and OT infrastructure is blurring, with companies expanding into ruggedized, plant-floor IoT hardware—broadening market demand.

IoT infrastructure is the foundation enabling connectivity and edge processing for IoT, and it is growing in tandem with device proliferation. Through 2030, expect substantial investments in gateways, networks, and edge compute as organizations seek to reliably connect and manage their ever-expanding IoT device fleets.

IoT IaaS (Infrastructure-as-a-Service)

IoT IaaS refers to the usage of cloud infrastructure services (like virtual servers, storage, databases) to support IoT workloads. Essentially, as companies collect massive amounts of IoT data and run IoT applications, they consume more cloud resources – making IaaS a critical part of the IoT ecosystem. In 2020, IoT-related IaaS spending was small (around $3 billion), but it grows to roughly $6 billion in 2025 and about $14 billion by 2030 (approximately 19% CAGR over 2025–30, the highest among segments listed). Key insights include:

- IoT Fuels Cloud Demand: Massive IoT data streams (from sensors, logs, video, etc.) are increasingly processed and stored in the cloud, significantly boosting demand for IaaS from providers like AWS, Azure, and Google Cloud. Use cases like smart city surveillance are driving petabyte-scale storage and compute needs.
- Scalability & Cost Efficiency: IoT's unpredictable data volumes make cloud elasticity essential. Businesses favor IaaS for its ability to scale on demand starting small and expanding rapidly—while benefiting from a pay-as-you-go model that aligns with IoT deployment growth.

- Cloud–Edge Synergy: Edge devices handle local processing but rely on the cloud for deeper analytics, long-term storage, and ML training. Cloud vendors offer integrated tools (e.g., AWS IoT SiteWise, Azure IoT Hub) to link edge and cloud seamlessly forming hybrid models at scale.

IoT and cloud infrastructure are deeply interlinked – IoT's growth translates into more demand for IaaS. Organizations will continue to leverage IaaS for its scalability, global availability, and advanced services (AI/analytics) to maximize IoT's value. The IoT IaaS segment's high CAGR reflects how crucial cloud infrastructure has become for IoT deployments, effectively making cloud computing an indispensable backbone for IoT going forward.

IoT Endpoints (Devices)

Endpoints refer to the physical devices in IoT – the sensors, actuators, smart objects, and "things" that are connected to the internet. This is the largest and most fundamental segment, often categorized as IoT hardware/devices. In 2020, global spending on IoT endpoints was about \$316 billion, rising to roughly \$242 billion in 2025 and projected around \$676 billion by 2030 (~11.8% CAGR from 2025 to 2030). This sustained growth is driven by the sheer volume of device deployments across consumer, enterprise, and industrial domains. Key insights:

Exhibit 54: Key Insights for IoT Endpoints Market

- Surging Device Volumes: IoT devices are set to more than double from 35.4 billion in 2022 to 74 billion in 2027. This rapid expansion is driven by falling hardware costs—many sensors now cost under \$5—making large-scale deployments in industries like logistics and agriculture more affordable.
- Diverse Use Cases Across Sectors: Growth spans industrial IoT (e.g., factory sensors, smart meters), consumer IoT (smart home devices, wearables), and automotive IoT (connected/autonomous vehicles). Endpoints enable remote monitoring, predictive maintenance, environmental tracking, and healthcare applications.
- Scalability & Innovation Trends: Organizations are shifting from pilot projects to mass-scale deployments—e.g., cities scaling smart infrastructure from hundreds to tens of thousands of units. Smaller, wireless, battery-powered sensors and disposable IoT tags are enabling deployments in hard-to-reach or transient environments.
- Challenges & Long-Term Outlook: Managing billions of devices requires strong lifecycle and security management tools. Standards like Matter and unified management platforms are emerging to ease this burden. As hardware costs stabilize, endpoints will remain the largest area of IoT spending through 2030, embedding connectivity into the fabric of everyday life.

IoT endpoints are the foundation of the entire IoT ecosystem – without devices generating data, there is no IoT. The world is on a path to tens of billions of connected things by 2030, driving a huge hardware market. Continuous innovation making devices cheaper, smarter, and more power-efficient will keep this segment growing strongly. IoT's promise of transforming business operations and daily life fundamentally relies on the ongoing deployment of endpoint devices at scale.

IoT Connectivity

The connectivity segment encompasses the networks and services that connect IoT devices to the internet and to each other. This includes spending on cellular IoT connectivity (e.g. 4G/5G connections for devices), low-power wide-area networks (LPWAN) subscriptions, satellite connectivity for IoT, and related networking hardware/services. In 2020, IoT connectivity spending was about $55 billion, reaching roughly $82 billion in 2025 and projected around $133 billion by 2030 (~10.3% CAGR from 2025 to 2030). This segment grows somewhat more slowly than others (since connectivity costs per device tend to drop even as device counts rise), but it is indispensable for IoT's expansion. Key trends and drivers:

- 5G Advancements: The global rollout of 5G is enabling real-time, high-bandwidth IoT applications—such as autonomous vehicles and smart surveillance. Its IoT-specific features (e.g., mMTC) allow mass deployment of low-power devices. Industries are adopting private 5G networks to support smart factories, logistics, and city automation.
- LPWAN Dominance: Low-power wide-area networks (NB-IoT and LoRaWAN) are the backbone for cost-effective, large-scale IoT. By 2030, these will support most of LPWAN IoT connections, with NB-IoT thriving in China and LoRaWAN elsewhere (agriculture, smart buildings), replacing costlier M2M cellular tech.
- Satellite IoT: Satellite networks are gaining traction for remote connectivity (e.g., maritime, deserts, wildlife). The satellite IoT market will continue to grow driven by LEO constellations and hybrid connectivity models that switch between terrestrial and satellite networks.
- Evolving Connectivity Business Models: Telcos are shifting from basic SIM/data services to full IoT connectivity management (eSIMs, cloud, analytics). 5G network slicing opens monetization opportunities via premium service tiers for critical applications.
- Cost and Scale Dynamics: Although ARPU per IoT device is declining due to ultra-low-cost LPWAN and data-light sensors, total revenues are growing with volume. By 2030, billions of cellular IoT devices (mostly on 4G/5G) will drive scale-led growth, making connectivity a key foundational segment in IoT.

Connectivity is the lifeline of IoT, and advancements in networking are directly enabling IoT's proliferation. The focus is on broadening coverage (through 5G, LPWAN, and satellite) and efficiently managing millions of connections. The IoT connectivity market will continue to expand in absolute terms, even as it transforms with new technologies – ensuring that every "thing" can communicate and participate in the IoT ecosystem

1.11.3.   IoT Devices in Top Application Areas

IoT technology is applied across countless use cases. The following are **top application areas** in the commercial IoT domain, highlighting the types of IoT devices deployed and their roles in each:

Exhibit 55: Top Application Areas for IoT Devices

Top Application Areas for IoT Devices

1. Portable Asset Tracking
2. OEM Telematics and Connected Vehicles
3. Smart Grid & Oil & Gas (Energy Sector IoT)
4. Building Automation (Smart Buildings)
5. Security & Surveillance
6. Factory & Industrial Automation
7. Fixed Asset Monitoring
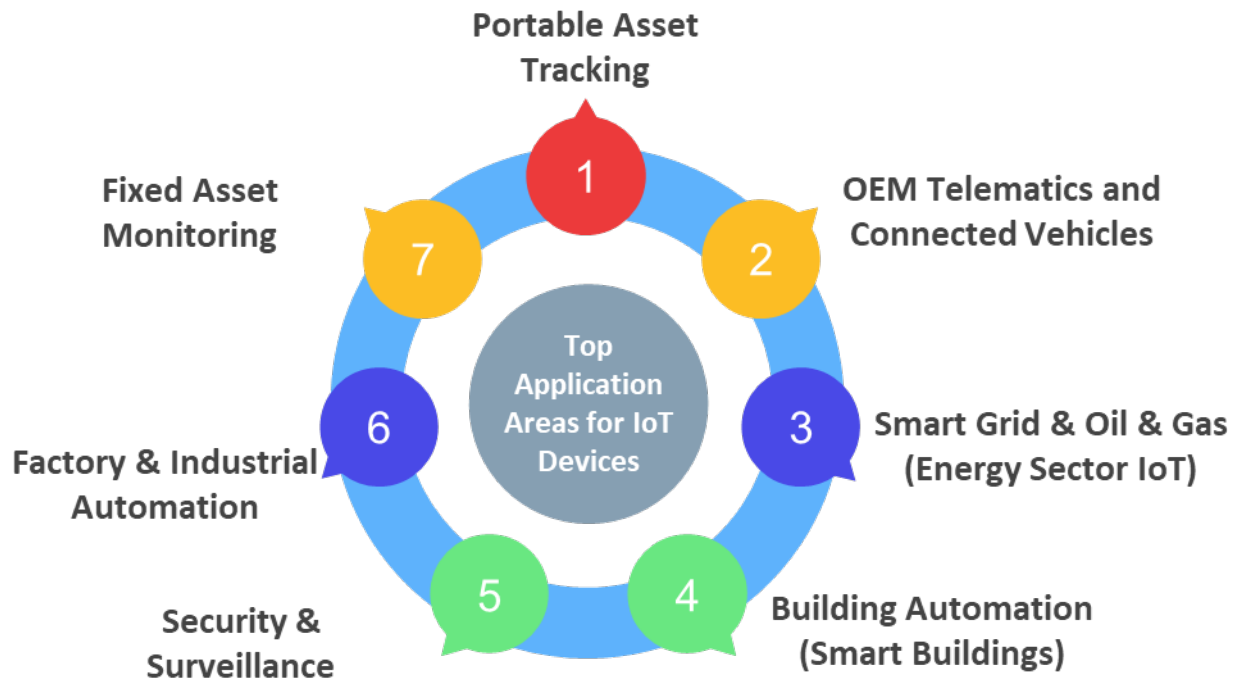
- **Portable Asset Tracking:** This category involves IoT devices used to track the location and status of movable assets – for example, shipments, packages, containers, vehicles, and portable equipment. Common IoT devices here include GPS trackers, cellular or satellite-based tracking units, RFID tags, and Bluetooth beacons attached to assets. These devices often have sensors (for temperature, shock, etc.) to monitor conditions during transit. A typical use case could be a logistics company equipping shipping containers or pallets with tracking devices to get real-time visibility into their supply chain. This helps prevent loss, optimize routing, and improve supply chain resilience. In fact, inventory intelligence and supply chain tracking are among the key IoT use cases globally, reflecting how critical asset tracking has become for businesses. For instance, IoT trackers are used by retailers to monitor high-value goods in transit, and by manufacturers to track components through production and delivery. The devices typically communicate over cellular networks (increasingly using LPWAN like NB-IoT for low-cost tracking) or via satellite for remote regions (e.g., tracking shipping containers crossing oceans). The portable asset tracking segment is growing as companies seek to strengthen logistics. IoT trackers in this area help reduce theft, enable just-in-time inventory by knowing exactly where goods are, and even monitor environmental conditions for sensitive products (e.g., cold chain monitoring for food/pharmaceuticals). Overall, portable asset tracking is a foundational IoT application underpinning modern logistics and transportation networks worldwide.
- **OEM Telematics and Connected Vehicles:** In the automotive sector, IoT has given rise to connected cars and telematics systems. Automakers (OEMs) now routinely include IoT devices in vehicles – these are typically telematics control units (**TCUs)** with cellular connectivity, GPS, and often Wi-Fi/Bluetooth capabilities, plus an array of sensors throughout the vehicle (for engine diagnostics, tire pressure, driver behaviour, etc.). A typical use case is these IoT devices enable vehicles to send data to the cloud and receive updates, which powers services like navigation with live traffic, remote vehicle diagnostics, emergency crash response (e.g., automatic 911 calls after an accident), and over-the-air software updates for the car. For commercial fleets, telematics devices allow tracking of fleet vehicles, driver performance monitoring, and route optimization. The connected car market is large and fast-growing and it's projected that most of new vehicles sold globally in 2030 will be connected. In other words, connectivity is becoming a standard feature in vehicles. By 2030, hundreds of millions of connected cars will be on the road. In the U.S. and Europe, essentially all major carmakers have IoT connectivity in new models (via embedded SIM cards or linking to smartphones). These IoT systems generate massive data (modern cars can have 100+ sensors streaming data). One outcome is the rise of usage-based insurance – insurers use telematics data on driving

behavior to adjust premiums. Another is vehicle-to-everything (V2X) communication: cars communicating with traffic lights, road sensors, or other cars to improve safety and traffic flow (this is emerging with 5G-enabled vehicles). Additionally, IoT connectivity in cars is the backbone for future autonomous driving, which requires constant data exchange. Beyond passenger cars, connected trucks and commercial vehicles are used for fleet management in logistics. Overall, IoT devices in connected vehicles constitute a major application area transforming transportation, with benefits in safety, efficiency, and new services (like connected infotainment and smart navigation).

- **Smart Grid & Oil & Gas (Energy Sector IoT):** The energy sector is a prominent field for IoT deployment, covering electric utilities (smart grids) as well as oil and gas industry applications. In smart grids, IoT devices like smart meters are installed at customer premises to digitally measure electricity (or gas/water) usage and communicate it to utilities. As of 2022, U.S. utilities alone had about 119 million smart electricity meters installed, covering 72% of households and many other countries have similar projects, with global smart meter installations exceeding 1 billion devices by 2023. These IoT meters provide granular usage data, enable time-of-use pricing, and support faster outage detection and recovery. Along with meters, utilities deploy sensors on distribution lines, transformers, and substations to monitor grid health, plus IoT control devices (automated switches, voltage regulators) to remotely manage the grid. The goal of a smart grid IoT is to improve reliability, reduce energy losses, integrate renewable energy (solar/wind) smoothly, and empower consumers to understand their energy usage. This is a significant application area – "smart grid" is consistently listed among top IoT investment categories. On the oil & gas side, IoT devices are used for remote monitoring of infrastructure: examples include sensors on pipelines (to detect pressure drops or leaks in real time), wellhead sensors for production monitoring, and equipment sensors on pumps, compressors, and drilling rigs for predictive maintenance. In large oil fields or offshore platforms, thousands of sensors feed into industrial IoT systems to optimize extraction rates and detect safety issues early. IoT in oil & gas also involves asset tracking (for oilfield equipment), worker safety wearables, and environmental monitors. These industries operate in harsh, often remote environments, so IoT devices are built rugged and may use satellite or LPWAN communications for connectivity. The **benefits** include preventing accidents (e.g., catching a pipeline leak before it worsens), improving operational efficiency (IoT can help schedule maintenance only when needed), and regulatory compliance (monitoring emissions, etc.). Combined, the **energy sector IoT** (utilities + oil & gas) is a major contributor to IoT market growth.

- **Building Automation (Smart Buildings):** In commercial buildings (offices, campuses, malls, hospitals, etc.), IoT devices are transforming how buildings are managed – often referred to as smart building or Building Management Systems (BMS) when IoT is integrated. Devices in this category include smart HVAC controllers (internet-connected thermostats and ventilation controls), occupancy sensors (motion or CO2 sensors in rooms to detect presence), smart lighting systems (LED lights with IoT control), access control and smart locks, elevator monitoring sensors, and indoor environment sensors (temperature, humidity, air quality). These devices feed into centralized building management software that optimizes the building's operation. A simple use case is when IoT sensors detect that a conference room is unoccupied and automatically turn off lights and adjust HVAC to save energy. Or occupancy data from sensors helps facility managers allocate space more efficiently. The key driver for building IoT is often energy efficiency and cost savings, as buildings account for a large share of energy use. By using IoT data, building systems can be automated to reduce waste (for example, adjusting cooling based on actual number of people sensed in an area). Another driver is improved security and comfort – IoT access systems increase security, and environmental sensors ensure occupant comfort and health. The smart building segment is experiencing rapid growth: The increasing number of IoT devices in commercial buildings worldwide indicate large-scale deployments of sensors and controls. This growth is buoyed by corporate sustainability goals (many companies now aim for "smart" and green certified buildings) and by technology trends like IoT gateways and edge computing specifically designed for buildings. Modern commercial real estate increasingly treats connectivity and IoT capabilities as a standard part of infrastructure, much like electrical or plumbing systems.

- **Security & Surveillance:** IoT has become integral to modern security and surveillance systems in both public and private sectors. Traditional CCTV cameras have evolved into IP cameras – these are IoT devices

that connect over networks, stream video, and can be managed remotely. In a typical smart surveillance setup, dozens or hundreds of IP cameras with high-definition video and sometimes onboard analytics (like motion detection) act as the "eyes," while IoT sensors like door/window sensors, motion detectors, and smart alarms complement them as the "ears." A simple use case is when a smart security system in a building would have connected cameras at all entrances, wireless motion sensors in restricted areas, and IoT door locks – all feeding into a cloud platform that security personnel monitor. Many cities globally have implemented connected surveillance networks for public safety, with thousands of cameras in urban areas (often augmented by IoT gunshot detection sensors or traffic monitoring devices). These IoT systems enable real-time monitoring from centralized command centers and can send alerts automatically (for example, if a camera's AI detects unusual behavior or if a door sensor triggers after hours). The benefit is enhanced security through faster response and deterrence (since the presence of connected cameras is a deterrent). Commercial enterprises also adopt IoT security: from smart retail security (RFID-based anti-theft systems, connected cameras that can be accessed remotely) to industrial facilities with IoT access controls and perimeter intrusion detection. Additionally, IoT tracking devices can secure assets (e.g., GPS trackers on valuable equipment provide theft recovery). The security IoT device market is large and the installed base of surveillance cameras globally already is in the hundreds of millions, many of which are IoT-enabled. As analytics (like facial recognition or license plate recognition) become more common, cameras often serve as IoT endpoints sending data to AI services. Moreover, smart home security overlaps here: though our focus is commercial, note that millions of consumers use IoT security cameras and smart doorbells, pushing the overall surveillance IoT numbers even higher. In summary, IoT devices for security and surveillance (cameras, sensors, alarms) are a top application area because safety and asset protection are universal needs – and IoT greatly enhances capabilities in this domain through connectivity and intelligent monitoring.

- **Factory & Industrial Automation:** Often termed Industrial IoT (IIoT), this is the application of IoT in factories, plants, and industrial processes – a core component of the "Industry 4.0" revolution in manufacturing. IoT devices in factories include industrial sensors (vibration, temperature, pressure, etc. mounted on machines), PLC (Programmable Logic Controller) connectivity modules to send machine data to the cloud, robotics and AGVs (automated guided vehicles) that are IoT-connected, and wearable devices for worker safety on the factory floor. Essentially, IIoT aims to create a smart factory where all equipment and operations are instrumented and interconnected. A simple use case is when a production line has IoT sensors on each critical machine (motors, conveyors). These stream data about performance and health to an analytics system that can predict if a machine is likely to fail soon – enabling maintenance to be scheduled proactively (avoiding unplanned downtime). In addition, real-time visibility into production (through IoT data dashboards) helps optimize workflows and inventory. Factory IoT devices also support automation – for instance, robotic arms can be IoT-controlled and coordinated, or material handling systems can be orchestrated via IoT. The impact of IoT in industrial automation is substantial: studies show significant reductions in downtime and improvements in productivity when IoT-driven predictive maintenance and process optimization are implemented. Globally, manufacturing operations is the top IoT use case, underlining how critical this area is. Industrial firms are increasingly equipping their legacy machines with IoT retrofit sensors to tap into the benefits of data. Moreover, new industrial equipment often comes IoT-ready from the factory (smart industrial equipment). IIoT is also applied in related environments like warehouses (for automation and inventory tracking) and mining/construction sites (monitoring heavy equipment and conditions). One important aspect is that many industrial IoT devices must operate in harsh conditions (extreme temperatures, vibration) and often use industrial networking protocols (Ethernet/IP, MODBUS, etc.) or private wireless networks on the factory site (including emerging private 5G networks for industry). The opportunity in factory IoT is still huge as most of the manufacturers have yet to fully scale IoT pilots across their operations, so as those pilots turn into large deployments, the market for IIoT devices and systems will boom. In conclusion, factory and industrial automation remains one of the most significant and valuable segments of IoT, driving efficiency and innovation in the global economy.

- **Fixed Asset Monitoring:** This category is related to industrial IoT but extends to any **stationary or fixed assets** that organizations need to monitor for operational continuity. "Fixed asset" implies infrastructure or

equipment that remains in one location (unlike portable asset tracking for mobile items). IoT devices for fixed asset monitoring include environmental sensors, condition monitoring devices, and smart meters installed on assets like machines, HVAC systems, generators, buildings, bridges, or even entire facilities. A simple use case is when a company might deploy IoT vibration and temperature sensors on a large industrial air compressor (a fixed asset) to continuously watch its health – if readings deviate from normal, maintenance crews are alerted to prevent a breakdown. Or consider data centers using IoT sensors to monitor temperature/humidity at server racks and detect water leaks under raised floors – protecting critical IT assets. In facilities management, fixed assets like elevators, chillers, or backup generators are outfitted with IoT monitors to track usage and predict failures. Infrastructure monitoring is another important application: cities use IoT sensors on bridges to monitor structural health (strain gauges, crack sensors) and on roadways for traffic/condition monitoring. Utilities monitor fixed assets like transformers and transmission lines using IoT sensors (thermal sensors, fault detectors). The value of monitoring fixed assets with IoT is improved reliability and lifespan of those assets – addressing problems proactively and optimizing maintenance cycles. One of the top use case is *production asset management*, which refers to monitoring and managing fixed assets in production environments. The IoT devices used are often low-power sensors with wireless connectivity that can be retrofitted onto existing equipment. Some are battery-operated and use mesh networks (e.g., Zigbee sensors in a building). Others might connect to local controllers that relay data. This segment overlaps with other categories: for instance, smart grid meters are essentially fixed asset monitors on the utility network. As IoT technology becomes more affordable, even relatively small fixed assets (like a motor or a pump) can have a dedicated sensor. The result is a continuous, remote visibility into asset performance that was not possible before, creating opportunities to optimize asset utilization and reduce downtime. With industries moving toward reliability-centered maintenance and digital twins of assets, fixed asset monitoring via IoT is an indispensable building block.

Each of these application areas demonstrates how IoT devices are being applied in the real world to create value. Collectively, they cover a huge portion of the commercial IoT deployments globally. It's worth noting that many IoT projects span multiple categories – for example, a smart factory might involve fixed asset monitoring (machines), portable asset tracking (tools or pallets in the factory), industrial automation, and even building automation (factory environment). The IoT market's growth is essentially the sum of growth in these myriad use cases, all enabled by connecting devices to gather data and automating responses. Table 1 below summarizes a few key metrics for selected application areas (global context):

1.11.4. United States IoT Market Overview

Market Landscape and Size (USA)

U.S. IoT Market: The United States is one of the largest IoT markets globally, accounting for roughly one quarter of worldwide IoT spending in 2020 at US$ 189 billion. U.S. IoT market value is estimated to be about US**$ 316 billion in 2025** and is forecast to grow to US**$ 530 billion by 2030** (ata CAGR of about 10.9%). The slightly slower growth rate compared to the global average reflects a maturing market, but the U.S. remains at the forefront of IoT adoption. Out of the total market potential, the consumer IoT market was US$ 52 billion in 2020, and is estimated to be US$ 87 billion by 2025 and US$ 146 billion by 2030. Similarly, non-consumer / commercial IoT was US$ 137 billion in 2020, and is estimated to be US$ 229 billion by 2025 and US$ 384 billion by 2030.

Exhibit 56: USA IoT Market, Split across Consumer and Commercial IOT, (USD Bn) - CY2020 – 2030F

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Consumer IoT	52	58	64	72	78	87	97	108	119	132	146
Commerial IoT	137	153	168	189	206	229	256	285	315	348	384

■ Commerial IoT ■ Consumer IoT
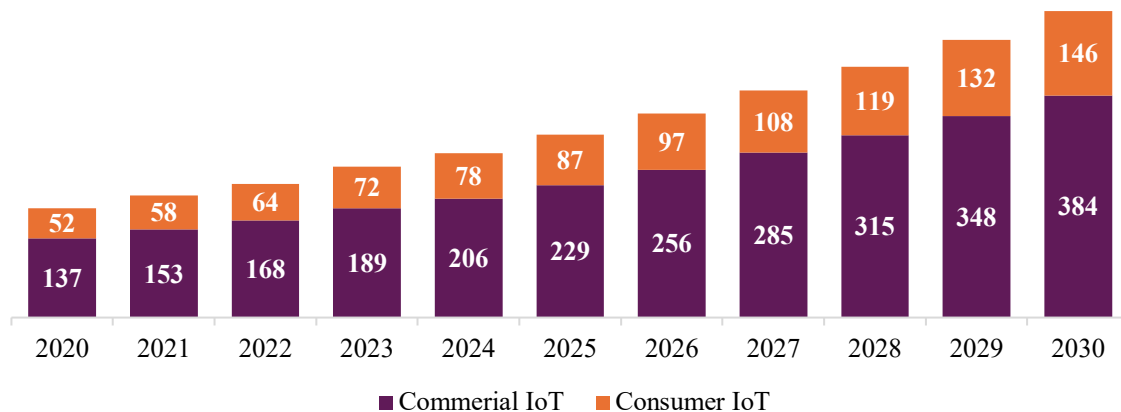
Source: Frost & Sullivan analysis

Key drivers in the U.S. include strong demand for smart factory solutions (Industrial IoT in manufacturing), federal and local investments in smart infrastructure (smart grids, smart cities), and the presence of major tech players fostering innovation. The rollout of 5G networks and LPWAN (LTE-M, NB-IoT) across the U.S. is enhancing IoT connectivity for applications like connected vehicles and industrial automation. U.S. firms also lead in integrating AI, cloud, and edge computing into IoT systems to enable real-time analytics and automation. Opportunities in the U.S. IoT market are significant in sectors such as smart manufacturing, energy/utilities, healthcare, and logistics, though organizations are equally focused on addressing cybersecurity and data privacy as IoT deployments expand.

The U.S. mirrors global trends with a strong presence of industrial and enterprise IoT. By component, hardware is the largest segment, as many devices and machines are being outfitted with IoT capabilities. However, IoT services (cloud services, integration, etc.) are growing fast in the U.S., indicating companies are increasingly investing in the software side to manage IoT deployments. Within US, IoT activity is widespread, but certain states and cities lead adoption (e.g., California's tech sector, Texas with energy IoT, the Midwest for manufacturing IoT, etc.). Urban areas pursuing smart city initiatives (New York, San Francisco, Chicago, etc.) also contribute significantly.

A notable characteristic of the U.S. market is that American companies have been early adopters of IoT at scale. As per demandsage.com, the U.S. leads in full-scale IoT deployment – about 44% of U.S. companies have extensively implemented IoT solutions, a higher share than any other country (UK was ~41%, Germany ~35% by comparison). This suggests that many U.S. firms have moved beyond pilot projects into operational IoT systems. Key sectors in the U.S. IoT landscape include manufacturing, transportation, energy, retail, healthcare, and government. Manufacturing and industrial IoT is particularly big, given the U.S. has a huge manufacturing output and a push for competitiveness via automation. The transportation sector (which covers connected vehicles and logistics) is also significant – think of all the fleet management systems, aviation IoT, and connected cars in the U.S. The energy/utilities sector in the U.S. is a major IoT adopter too: as of 2023, about 128 million smart electricity meters have been installed, covering ~76% of U.S. electric customers as per US Energy Information Administration, and there are ongoing efforts to modernize the grid with IoT sensors. Retail and commerce in the U.S. leverage IoT for supply chain and inventory (big retailers like Walmart, Amazon heavily use IoT in warehouses and tracking), as well as in-store tech. Healthcare IoT is growing with remote patient monitoring and smart medical devices, especially as telehealth expanded post-2020. Finally, the public sector: U.S. cities are implementing smart city tech (smart traffic lights, public safety surveillance, smart street lighting, etc., often funded by local governments or federal grants).

It's also worth noting the role of U.S. tech companies in the IoT market. Many of the leading IoT platform providers and networking companies are U.S.-based, and they have been investing strongly in IoT offerings. This creates an ecosystem where American enterprises have ready access to cutting-edge IoT technologies and

expertise. Additionally, venture capital and startup innovation in IoT is very active in the U.S., contributing to market vibrancy (IoT startups in areas like smart agriculture, IoT cybersecurity, etc., continually emerging).

The U.S. IoT market as of mid-decade (2025) is a large, mature segment of the global IoT landscape, with high adoption rates in many industries. While growth is a bit slower percentage-wise than some developing markets, the U.S. will continue to add significant IoT spending given the scale of its economy. By 2030, the U.S. will likely remain one of the top two IoT markets globally (the other being China), with hundreds of millions of connected devices deployed nationwide across various applications.

Key Trends in the U.S. IoT Market

Many global IoT trends are also reflected in the U.S., but there are some nuances and areas of emphasis in the U.S. context. Key U.S.-specific IoT trends include:

Exhibit 57: Key Trends in U.S. IoT Market
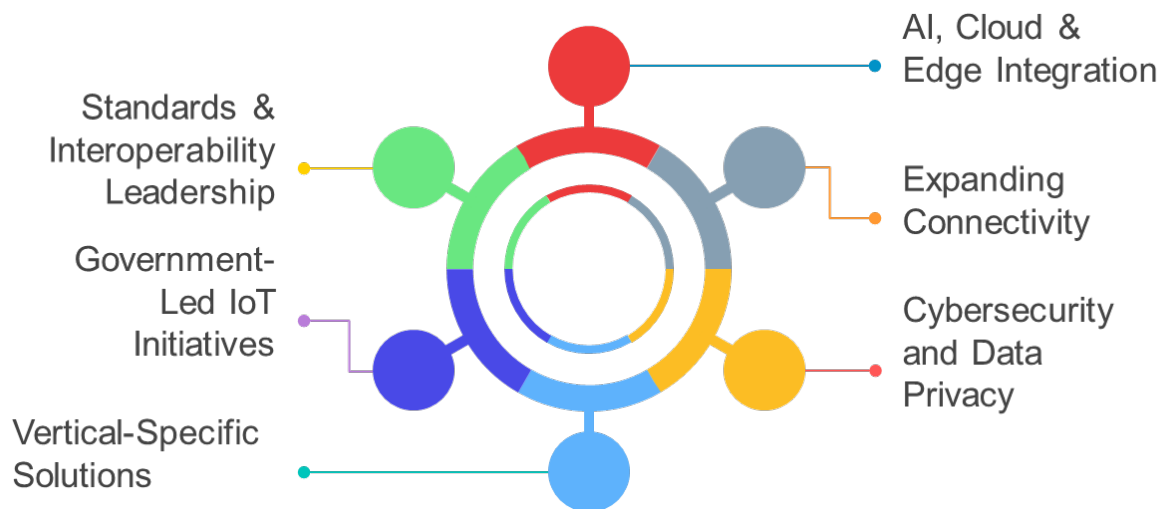
- AI, Cloud & Edge Integration: U.S. firms are leading in fusing AI with cloud and edge computing to create smarter IoT systems. There's a strong shift toward software-driven IoT, with real-time edge analytics used in manufacturing, healthcare, and logistics (e.g., edge AI for patient monitoring or robotic control). Cloud platforms like AWS IoT and Azure IoT enable large-scale data processing, while edge computing ensures low latency. This convergence supports automation, predictive maintenance, and AI-led decision-making across industries—accelerating digital transformation.
- Expanding Connectivity: 5G, Private Networks, and LPWA: 5G deployment across the U.S. supports high-bandwidth IoT applications (like V2X and drones) and offers features like network slicing. Enterprises are adopting private 5G/LTE networks using CBRS spectrum—common in factories and ports—to secure IoT communication. LPWAN (LTE-M, NB-IoT, LoRaWAN) is prevalent in utility, smart agriculture, and rural deployments. Each network type serves distinct needs, enabling scalable IoT use cases from smart cities to defense systems.
- Cybersecurity and Data Privacy: Security is a top priority in the U.S. IoT landscape, shaped by laws like the IoT Cybersecurity Improvement Act and California's device security rules. Companies now design security into devices from the start using encryption, zero-trust frameworks, and continuous monitoring. Blockchain pilots are emerging for IoT authentication. Privacy compliance with regulations like CCPA is also crucial, leading to features such as data anonymization and user consent controls. Telcos are bundling IoT connectivity with managed security services to build trust and adoption.
- Vertical-Specific Solutions: U.S. vendors are tailoring IoT platforms for industries like oil & gas, healthcare (HIPAA-compliant), agriculture, and manufacturing. These solutions come pre-packaged with sector-specific features—like smart building platforms integrating HVAC, security, and energy analytics. This verticalization reduces deployment friction and boosts ROI, with many firms forming partnerships to co-develop solutions. Dedicated go-to-market teams per sector reflect the market's maturity.

- Government-Led IoT Initiatives: Federal investments—via legislation like the 2021 Infrastructure Investment and Jobs Act—are fueling IoT deployment in power grids, smart transportation, and EV infrastructure. Initiatives support use cases like grid sensors, vehicle-to-infrastructure systems, and remote medical care (e.g., VA telehealth pilots). USDA-backed precision agriculture and onshoring strategies further embed IoT into national growth priorities.
- Standards & Interoperability Leadership: The U.S. contributes actively to global IoT standards (NIST, IEEE, IETF) and promotes interoperability. Initiatives like the Matter protocol (backed by Apple, Google, Amazon) and consortia like the Industry IoT Consortium are pushing unified frameworks. Open-source contributions and dominant ecosystems (e.g., Alexa, Azure Digital Twins) are reducing fragmentation, enabling easier IoT adoption—especially for SMEs and municipalities.

Overall, the U.S. IoT market trends reflect a drive towards more intelligent, secure, and industry-focused IoT implementations, underpinned by advanced connectivity. The U.S. continues to innovate in how IoT is used (often setting examples that get exported globally), while also focusing on addressing the challenges (security, integration) to fully capitalize on IoT's benefits.

1.11.5. Drivers and Opportunities in the U.S. IoT Market

The U.S. market's IoT growth is propelled by several **key drivers**, and there are notable **opportunities** specific to the U.S. environment that stakeholders are leveraging:

Exhibit 58: Drivers & Opportunities for U.S. IoT Market
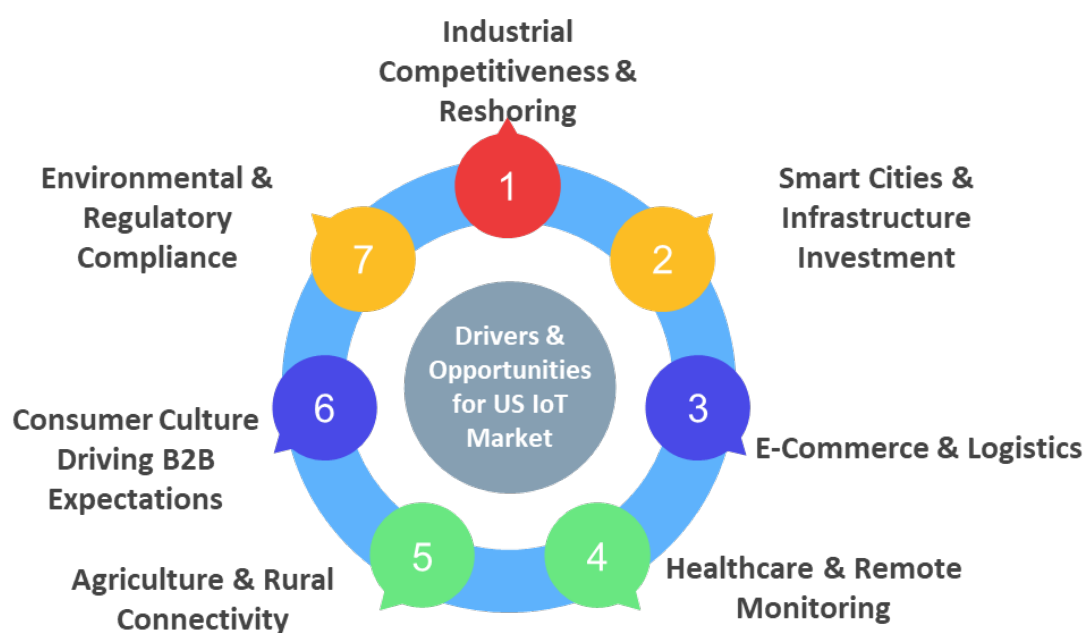
- Industrial Competitiveness & Reshoring: U.S. industries are embracing IoT to enhance productivity, reduce costs, and compete globally. With reshoring efforts underway, new manufacturing sites are adopting IoT and automation from the outset. Government incentives (e.g., for semiconductor fabs) often include provisions for sensorized, smart operations—boosting demand for IoT in digital manufacturing under initiatives like "Manufacturing USA."
- Smart Cities & Infrastructure Investment: Federal and local funding, including the 2021 Infrastructure Bill, is accelerating IoT use in transportation (smart traffic lights, V2I), utilities (smart grids), and safety (surveillance sensors). City initiatives (e.g., NYC traffic systems, LA smart lighting) are setting precedents. States like Texas and Colorado are adopting smart city technologies, creating public-sector demand for IoT integrators.
- E-Commerce & Logistics: Driven by giants like Amazon and UPS, IoT is streamlining warehousing (robots, sensors) and delivery (telematics for fleet tracking). The emphasis on supply chain resilience post-

COVID has increased demand for IoT-based asset tracking and predictive analytics. Future trends such as drone and autonomous delivery create further opportunities.

- Healthcare & Remote Monitoring: The U.S. healthcare system is scaling IoMT (Internet of Medical Things) for patient monitoring, asset tracking, and cost efficiency. Devices like wearables and home monitors transmit data to providers, often reimbursed by insurers. Hospitals deploy IoT for safety and logistics. Regulatory support (e.g., FDA digital health guidance) and a shift toward value-based care are accelerating adoption.

- Agriculture & Rural Connectivity: Precision agriculture in the U.S. uses IoT for crop, soil, and livestock monitoring. With better rural broadband (federally funded), IoT use is expanding in remote areas. Major equipment makers (e.g., John Deere) are integrating IoT into machines. Agri-IoT improves efficiency and supports food security, with startups driving innovation in irrigation, drones, and livestock health tracking.

- Consumer Culture Driving B2B Expectations: A tech-savvy U.S. consumer base accelerates IoT familiarity and expectations in commercial settings. Popular smart home devices influence demand for smart features in offices, vehicles, and stores. Innovation spillover from consumer to enterprise (e.g., drone tech, AI assistants) sustains a vibrant IoT startup ecosystem that feeds both B2C and B2B growth.

- Environmental & Regulatory Compliance: Regulations from OSHA, EPA, and DOT are mandating real-time monitoring—creating enforced demand for IoT. Use cases include emission tracking, cold chain compliance, and worker safety devices. Such mandates make IoT adoption a necessity in certain sectors, especially in energy, manufacturing, food, and transport.

  The drivers in the U.S. IoT market range from economic (efficiency, innovation, competitiveness) to governmental (infrastructure funding, regulations) and even social (healthcare needs, consumer expectations). These factors together ensure that IoT remains a high priority in digital strategy for U.S. organizations. The **opportunities** for growth include expanding IoT into sectors that are just beginning (healthcare, small/medium businesses, etc.), leveraging the latest tech (5G, AI) to create next-gen IoT solutions, and solving pain points like security to unlock even broader adoption (for instance, companies that provide easy end-to-end secure IoT solutions stand to gain many clients who have been cautious so far).

The **global IoT market** is on a strong growth trajectory, driven by technological advancements and the universal pursuit of efficiency and innovation across industries. By 2030, IoT will be deeply embedded in most aspects of business and infrastructure globally – from factories producing goods, to the energy grids powering cities, to the vehicles moving people and products, and the buildings housing work and life. The **market is** characterized by rapid device proliferation (tens of billions of connected devices), robust investment, and transformative impacts on operations. Key trends such as 5G connectivity, cloud-edge integration, and AI analytics are not only fueling IoT growth but also expanding its capabilities, enabling more sophisticated and valuable use cases.

The **United States**, exemplifies a market that has embraced IoT broadly – leveraging it to bolster industrial competitiveness, modernize infrastructure, and address sector-specific challenges (like healthcare delivery and supply chain resilience). The U.S. IoT market, already the world's largest in value, continues to grow and innovate, albeit at a measured pace relative to some emerging markets. We see that U.S. enterprises lead in actual deployments at scale, thanks in part to an ecosystem of leading IoT tech providers and a culture of digital transformation. With strong drivers (economic, governmental, and consumer-driven) and targeted opportunities (in areas like smart manufacturing, smart cities, and IoT security), the U.S. is expected to remain a pacesetter in IoT adoption through 2025–2030.

Both globally and in the U.S., the market drivers – cost reductions, efficiency needs, government support, and synergy with new tech – are well-aligned to sustain IoT expansion. Meanwhile, stakeholders from device makers to software firms to end-users are collaboratively overcoming challenges (interoperability, security) to realize IoT's full potential. The IoT revolution is still in its middle stages; particularly in B2B settings where scaling successful pilots enterprise-wide remains a hurdle. This implies significant headroom for growth and maturation in the coming years.

1.11.6. Regional IoT Market Overview

Exhibit 59: Global IOT Market, Split across Regions, (USD Bn) - CY2023 – 2030F
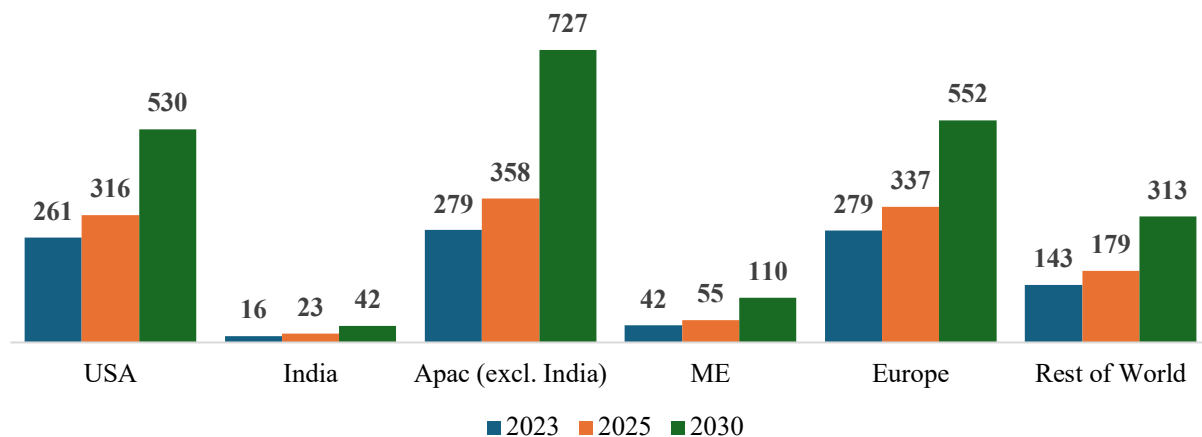
Exhibit 60: Global Consumer IOT Market, Split across Regions, (USD Bn) - CY2023 – 2030F
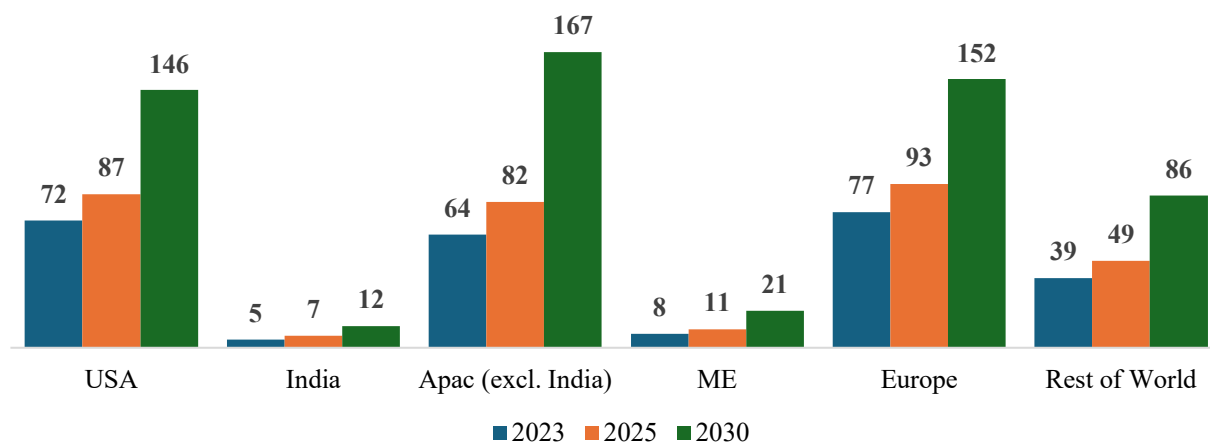
Exhibit 61: Global Commercial IOT Market, Split across Regions, (USD Bn) - CY2023 – 2030F
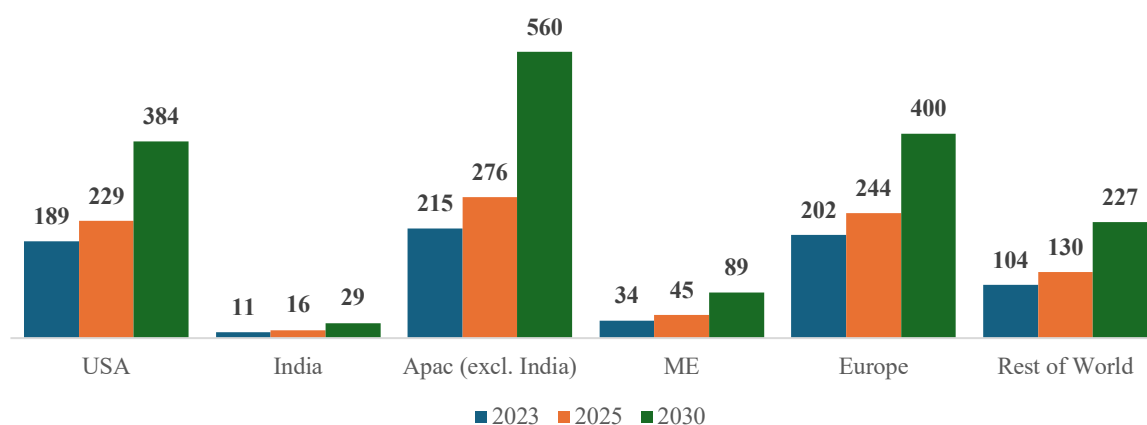
1.11.7. India Commercial IOT Market Overview

India's commercial IoT sector is on a rapid growth trajectory. The government's push for digitization through initiatives like Digital India and the Smart Cities Mission has been a major driver of IoT adoption. These programs focus on modernizing infrastructure and public services (e.g. smart transportation, utility monitoring), creating

strong demand for IoT solutions in urban development. Additionally, key industries are embracing IoT: for instance, agriculture is using IoT-based precision farming and automated irrigation, manufacturing firms are deploying IoT for real-time production monitoring, and healthcare providers are adopting connected devices for telemedicine and patient monitoring. The rollout of 5G networks across India further accelerates these trends by enabling more reliable, high-bandwidth connectivity for IoT deployments. By 2030, experts anticipate significant advancements in industrial IoT (IIoT) and smart healthcare solutions, supported by 5G's low-latency connectivity and the country's improving digital infrastructure.

The India IOT market was valued at US$ 16 billion in 2023 and US$ 23 billion in 2025. The market is expected to grow to US$ 42 billon by 2030 growing at a CAGR of 13.2% in the 2025-2030 period. The India commercial IOT market was valued at US$ 11 billion in 2023 and US$ 16 billion in 2025. The market is expected to grow to US$ 29 billon by 2030 growing at a CAGR of 13.2% in the 2025-2030 period.

Drivers: Several factors are propelling IoT growth in India. Government support is paramount as policies and projects under Digital India, along with sector-specific programs (e.g. smart grid initiatives in energy, or IoT use in irrigation under agricultural modernization schemes), encourage enterprises to invest in IoT. A booming tech startup ecosystem and IT services industry also contribute, providing IoT platforms and analytics tailored for Indian business needs. The declining costs of IoT hardware and cloud services make commercial IoT more accessible to Indian companies. Moreover, India's large mobile network footprint (and ongoing fiber broadband expansion) improves connectivity even outside major cities, gradually reducing the urban-rural digital divide. Local examples include smart city projects in cities like Bengaluru and Pune deploying IoT-based traffic management and surveillance, and state-led initiatives such as Telangana's use of IoT in irrigation management for water conservation (drip irrigation sensors). Such examples illustrate IoT's perceived value in tackling local challenges like congestion, resource scarcity, and service delivery efficiency.

1.11.8. Asia-Pacific Commercial IOT (Excluding India) Market Overview

The Asia-Pacific (APAC) region (excluding India) is poised to move from a relative IoT laggard to a global leader in the coming years. While APAC's enterprise IoT adoption initially trailed other regions, it now shows unparalleled capacity for growth. No other region is expected to add IoT connections as rapidly; APAC will account for a significant share of the tens of billions of IoT devices in use globally by 2030. This surge is underpinned by strong investments and digitalization across APAC's diverse economies. Notably, China stands out as a powerhouse and it is already one of the world's largest IoT markets, driven by a robust manufacturing sector and government-backed smart city programs. The "Made in China 2025" industrial strategy explicitly prioritizes IoT integration in manufacturing to boost efficiency and productivity. Chinese tech giants (Alibaba, Tencent, Baidu) and telecom providers are heavily investing in IoT platforms and services, spurring adoption across sectors from energy to retail. Japan, likewise, leverages its strengths in electronics and robotics to advance IoT in manufacturing and logistics. Japanese firms have widely implemented industrial IoT solutions for factory automation and predictive maintenance, and the country's aging population has prompted innovative IoT applications in healthcare (such as remote patient monitoring and eldercare robots). Other developed APAC economies like South Korea, Singapore, Australia are also early adopters. For example, South Korea's nationwide 5G rollout provides an ultra-fast network foundation for IoT (enabling smart factory and autonomous vehicle projects), and Singapore's Smart Nation initiative uses IoT sensors for everything from intelligent transport systems to energy-efficient buildings, setting a regional benchmark for smart-city innovation. Meanwhile, emerging Southeast Asian countries (Malaysia, Thailand, Vietnam, among others) are starting to implement IoT in agriculture, manufacturing and urban infrastructure, though at a more modest scale compared to East Asia.

The APAC (excl. India) IOT market was valued at US$ 279 billion in 2023 and US$ 358 billion in 2025. The market is expected to grow to US$ 727 billon by 2030 growing at a CAGR of 15.2% in the 2025-2030 period. The APAC (excl. India) commercial IOT market was valued at US$ 215 billion in 2023 and US$ 276 billion in 2025. The market is expected to grow to US$ 560 billon by 2030 growing at a CAGR of 15.2% in the 2025-2030 period.

Drivers: A combination of economic, technological, and policy factors is driving APAC's IoT boom. One major driver is the push for industrial automation and efficiency across the region. Manufacturers in APAC see IoT as key to increasing productivity and competitiveness and this is evident in initiatives like Industry 4.0 programs in countries such as China, Japan, and South Korea, and "Thailand 4.0" which focuses on smart electronics and automation. Another driver is the rapidly expanding internet and mobile broadband access in APAC. Widespread connectivity (including billions of smartphone users and extensive 4G/5G networks) provides the necessary infrastructure for IoT solutions to thrive, even enabling leapfrog opportunities in developing markets. Government policies and national strategies also play a vital role. Beyond China's well-funded IoT plans, other governments have launched IoT-friendly policies: Japan's Society 5.0 vision marries IoT with AI to address societal issues; South Korea invests in smart factories and IoT testbeds under its Digital New Deal; Malaysia released a National IoT Strategic Roadmap to spur IoT in key sectors; and Australia focuses on IoT in agriculture and mining to improve safety and output. Moreover, the private sector in APAC is highly active as telecom operators, global and local enterprises, and a vast startup ecosystem are competing and collaborating to deliver IoT services. This competitive landscape, featuring partnerships between device manufacturers, platform providers, and telecom carriers, is accelerating innovation. For example, Chinese operators have deployed nationwide NB-IoT networks for low-power sensors, and Japanese manufacturers are partnering with IT firms to develop smart factory solutions. Finally, external factors such as urbanization and sustainability are fueling IoT adoption: APAC's mega-cities are turning to IoT for traffic management, pollution monitoring, and disaster management, and companies are using IoT to meet energy efficiency and carbon reduction goals.

1.11.9. Middle East Commercial IOT Market Overview

The Middle East is experiencing a rapid rise in commercial IoT adoption, led by ambitious national visions and smart infrastructure projects. In particular, the oil-rich Gulf Cooperation Council (GCC) states are emerging as IoT innovation hubs. Saudi Arabia and the United Arab Emirates (UAE) exemplify this trend, thanks to visionary government initiatives like Saudi Vision 2030 and UAE's Smart Dubai strategy. These long-term plans aim to diversify economies away from oil by investing heavily in technology, smart cities, and digital services. IoT is a cornerstone of these transformations. As a result, the Middle East's IoT connections are growing at one of the fastest rates in the world, second only to Asia-Pacific. Smart city development is a key IoT use case across the region: flagship projects such as NEOM in Saudi Arabia and Masdar City in Abu Dhabi are building hyper-connected, sustainable cities from the ground up, embedding IoT sensors and automation in everything from energy grids to transportation systems. These projects are redefining urban living with intelligent designs that leverage IoT to minimize environmental impact and improve quality of life. Beyond greenfield smart cities, existing metropolitan areas like Dubai, Riyadh, and Doha are installing IoT solutions for traffic management (intelligent traffic signals, connected public transit), public safety (smart surveillance, emergency response systems), and utilities (smart water and electricity meters). Another stronghold for IoT in the Middle East is the oil & gas industry. Companies in Saudi Arabia, UAE, Qatar, and Kuwait are deploying industrial IoT sensors on oil wells, pipelines, and refineries to enable predictive maintenance, optimize production, and enhance safety in operations. This "digital oilfield" approach helps reduce downtime and operational costs. Likewise, sectors such as logistics (e.g. IoT-enabled port operations in Dubai's Jebel Ali Port), retail (with Gulf retailers experimenting with IoT-based inventory tracking and smart checkout systems), and healthcare (remote health monitoring and smart hospital initiatives) are progressively adopting IoT.

The Middle East IOT market was valued at US$ 42 billion in 2023 and US$ 55 billion in 2025. The market is expected to grow to US$ 110 billon by 2030 growing at a CAGR of 14.8% in the 2025-2030 period. The Middle East commercial IOT market was valued at US$ 34 billion in 2023 and US$ 45 billion in 2025. The market is expected to grow to US$ 89 billon by 2030 growing at a CAGR of 14.8% in the 2025-2030 period.

Drivers: The Middle East's IoT market is propelled by strong top-down support and economic modernization goals. Government-led strategies are the primary drivers. Saudi Arabia's Vision 2030, for instance, explicitly calls for developing smart cities and digital infrastructure; it has catalyzed public and private investment in IoT projects to improve citizen services and industrial efficiency. In the UAE, the Smart Dubai program and UAE Vision 2021/2051 agenda have similarly driven IoT uptake in governance (e.g. smart policing, e-government services) and urban management. A key driver in the region is the desire to diversify economies and create knowledge-

based industries. IoT and digital tech are seen as opportunities to generate new jobs and reduce reliance on oil revenue. This is evident in initiatives like Qatar's National Vision 2030 and Oman's Digital Strategy, which include components for IoT-driven development in sectors like transportation, energy, and manufacturing. The rollout of advanced telecom networks also underpins IoT growth. Gulf countries were among the first to launch 5G networks commercially, and this ultra-fast connectivity enables high-density IoT deployments (for example, Bahrain's 5G allows smart port and fintech IoT applications). Moreover, the Middle East's relatively young, urbanized population and high smartphone penetration foster an environment enthusiastic about tech adoption, which spills into enterprise expectations for IoT solutions. Another driver is the focus on smart infrastructure for mega-events and mega-projects. For example, Expo 2020 in Dubai and the 2022 FIFA World Cup in Qatar showcased smart city technologies (smart parking, connected venues, etc.), leaving behind IoT infrastructure legacies. Local examples of IoT momentum include the Dubai Electricity and Water Authority installing tens of thousands of smart meters and IoT sensors to create a smart grid, and Saudi Aramco's deployment of thousands of sensors in oil facilities for real-time monitoring. Such successes demonstrate IoT's value in improving efficiency and are encouraging wider adoption across the region.

1.11.10. Europe Commercial IOT Market Overview

Europe's commercial IoT landscape is characterized by steady growth and a strong emphasis on industrial and enterprise applications. Europe is the world's third-largest IoT adopter (after Asia-Pacific and North America), with its market expanding at a healthy double-digit pace. Unlike some regions, Europe's IoT spending is dominated by the industrial and enterprise segment rather than consumer gadgets. In fact, although connected consumer devices (like smart appliances and wearables) are numerous, they account for a relatively small portion of IoT expenditures in Europe. The bulk of investment is flowing into Industrial IoT (IIoT) – connecting machines, vehicles, and infrastructure in sectors such as manufacturing, transportation, energy, and healthcare. The continent's focus on Industry 4.0, a concept born in Germany, encapsulates this trend. Across Europe, factories and supply chains are being upgraded into "smart factories" that leverage IoT sensors, robotics, and AI to enable real-time data collection, automation, and analytics-driven decision making. For example, German automotive plants utilize IoT to track parts and predict equipment maintenance needs, French utilities deploy IoT sensors for smart grids and energy efficiency, and Nordic countries employ IoT in smart building management to reduce energy consumption. 5G network rollouts are also supporting new IoT use cases, such as private 5G networks on factory floors to connect machinery with ultra-low latency. By 2030, manufacturing is expected to generate the largest share of IoT's economic value in Europe (estimated around a quarter of total value). Other important verticals include healthcare where IoT is used for remote patient monitoring, medical asset tracking, and even connected medical devices in hospitals and transportation/logistics, with Europe pioneering connected car technology, smart logistics hubs, and IoT-based public transportation systems. Smart city initiatives are prevalent as well: cities like Amsterdam, Barcelona, and Stockholm have IoT projects ranging from smart street lighting and parking to environmental monitoring. These efforts align with Europe's sustainability goals, using IoT to optimize resource usage and reduce emissions (for instance, smart meters for water/electricity and IoT-based traffic flow management to cut congestion).

The European IOT market was valued at US$ 279 billion in 2023 and US$ 337 billion in 2025. The market is expected to grow to US$ 552 billon by 2030 growing at a CAGR of 10.4% in the 2025-2030 period. The European commercial IOT market was valued at US$ 202 billion in 2023 and US$ 244 billion in 2025. The market is expected to grow to US$ 400 billon by 2030 growing at a CAGR of 14.8% in the 2025-2030 period.

Drivers: The drivers of IoT growth in Europe include both technology push and demand pull factors. On the technology side, the maturation of enabling tech like affordable sensors, cloud and edge computing, and AI is making IoT solutions more powerful and cost-effective, enticing businesses to invest. The widespread availability of high-quality networks (broad 4G coverage, expanding 5G, and dedicated IoT networks like LoRaWAN and NB-IoT in many countries) provides a solid backbone for IoT deployments. On the demand side, European industries are motivated by the promise of efficiency gains and innovation. Initiatives under Industry 4.0 serve as a rallying point and roadmap for many companies. Governments and the EU have been supportive as well: the European Union has funded research and pilot programs (for example, through Horizon Europe projects on IoT and AI, and the Alliance for Internet of Things Innovation) to encourage IoT adoption in manufacturing,

agriculture, and smart cities. National strategies in major economies mirror this push like Germany's "Industrie 4.0" program, France's "Industrie du Futur", and similar digital transformation agendas in Italy and Spain all emphasize IoT as key to modernizing industry. Regulatory developments also play a role as drivers by creating an environment of trust and interoperability. For instance, the EU's new Data Act (coming into effect mid-2025) will require companies to make data from IoT and other devices more accessible to users and third parties, which is intended to stimulate a competitive data economy and new services. This regulatory push, alongside Europe's strong privacy frameworks (GDPR), aims to balance innovation with data rights and may indirectly drive companies to invest in compliant, advanced IoT data management capabilities. Another driver is Europe's policy focus on sustainability and resilience. IoT is seen as a tool to help achieve climate and energy targets, for example, IoT sensors in agriculture reduce water and fertilizer usage (supporting EU Green Deal goals), and smart grid IoT helps integrate renewables into energy networks. The COVID-19 pandemic also highlighted IoT's value in resilience, from remote monitoring of production lines to telehealth, accelerating digitalization efforts. Finally, Europe's strong industrial base and global competitiveness goals push companies to adopt IoT so as not to fall behind international rivals. Sectors like automotive, aerospace, and chemicals where European firms are global leaders are heavily investing in IoT to maintain that edge through superior operational efficiency and product innovation.

1.11.11. Global IoT Device Footprint by Application – 2025 Outlook

Exhibit 62: Global & USA: Total Internet of Things (IoT) Device Forecast, 2025, in Million
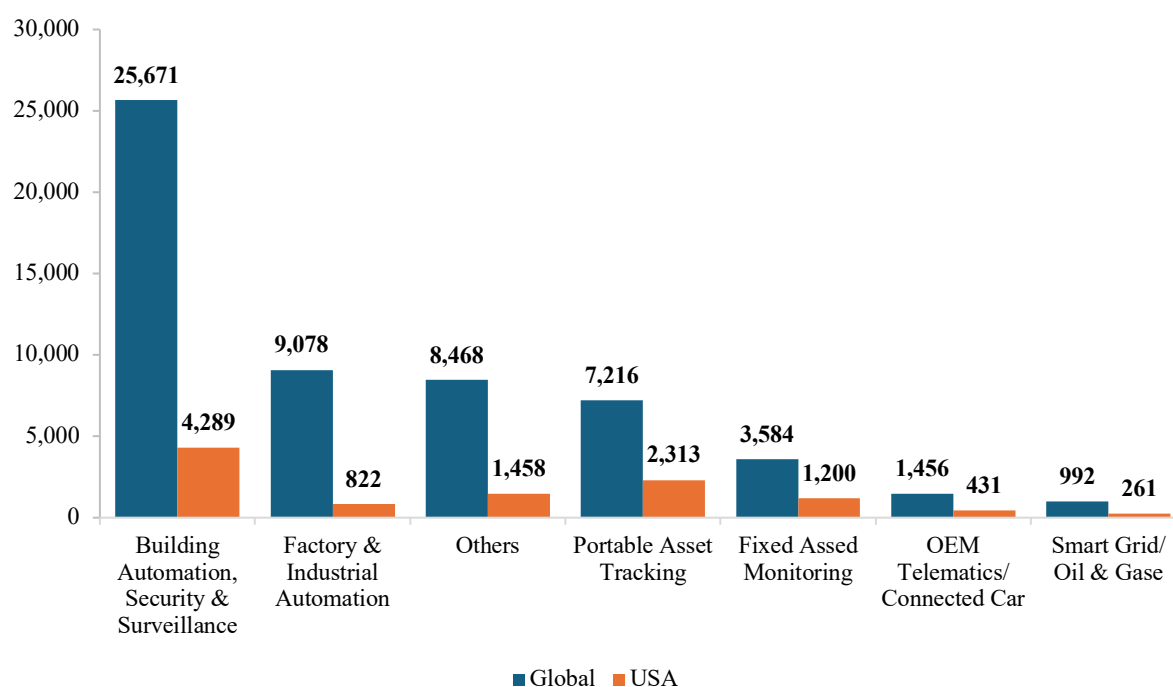
Source: Frost & Sullivan analysis

As the global Internet of Things (IoT) ecosystem matures, the number of deployed devices continues to surge, with distinct growth across various use cases. In 2025, the total device count across leading application categories highlights where adoption is most concentrated and why.

1. Building Automation, Security & Surveillance – 25.7 Billion Devices Globally | 4.3 Billion in the U.S.

Building Automation, Security and surveillance dominate the global IoT landscape, accounting for nearly **26 billion connected devices**. This includes IP cameras, motion detectors, gunshot sensors, facial recognition terminals, and access control systems. The surge is driven by urbanization, rising concerns over public safety, and government smart city initiatives. Cities like Chicago and Shanghai have deployed tens of thousands of interconnected surveillance nodes, often with AI-powered analytics for real-time monitoring.

In the private sector, businesses are scaling up their security infrastructure using networked cameras and smart locks, while the consumer market continues to boom with smart doorbells and home surveillance kits. The U.S. accounts for 4.3 billion devices, highlighting mature adoption among municipalities, enterprises, and homes alike.

2. Factory & Industrial Automation – 9.1 Billion Devices Globally | 0.8 Billion in the U.S.

The industrial automation segment is growing steadily with over **9 billion devices** globally. This includes sensors embedded in machinery, robotic systems, programmable logic controllers (PLCs), predictive maintenance tools, and digital twins.

Industrialized economies, especially in Asia and Europe, are automating aggressively to enhance productivity and cope with labor shortages. In the U.S., sectors like automotive, aerospace, semiconductor, and food processing are implementing IoT systems for condition monitoring, real-time diagnostics, and output optimization.

3. Others (Smart Homes, Retail, Healthcare, Environment, etc.) – 8.5 Billion Devices Globally | 1.5 Billion in the U.S.

This diverse category includes smart home devices (thermostats, lights, appliances), connected retail (shelf sensors, beacons), healthcare wearables, and environmental monitoring tools.

Smart home adoption has skyrocketed due to growing consumer awareness, integration with digital assistants, and energy-efficiency mandates. In retail, brands use IoT for inventory management and real-time customer interaction. The healthcare sector, particularly post-pandemic, has embraced IoT for remote monitoring and diagnostics.

4. Portable Asset Tracking – 7.2 Billion Devices Globally | 2.3 Billion in the U.S.

Asset tracking represents a key growth vertical, reaching **7.2 billion devices** globally, with a strong U.S. footprint. Logistics, warehousing, and supply chain players use GPS trackers, BLE beacons, and RFID tags to monitor cargo, containers, and individual items across transit nodes.

Growth is fueled by e-commerce, just-in-time delivery models, and post-COVID supply chain resilience planning. Cold chain logistics, particularly in food and pharmaceuticals, are a key subsegment. The rise of smart ports and connected railroads has also boosted adoption.

5. Environmental & Remote Monitoring – 3.6 Billion Devices Globally | 1.2 Billion in the U.S.

Remote monitoring applications, especially in utilities, agriculture, and environmental sectors, account for **3.6 billion devices** globally. This includes water level sensors, pollution detectors, weather stations, and pipeline monitoring tools.

In agriculture, IoT is enabling precision farming by monitoring soil conditions and automating irrigation. In cities and factories, regulatory pressure is pushing real-time monitoring of emissions, air quality, and waste management. The U.S. uses a significant share of these devices across water utilities, energy grids, and smart farming projects.

6. Connected Car & Vehicle Telematics – 1.5 Billion Devices Globally | 0.4 Billion in the U.S.

The connected car market sees **1.5 billion devices** in use globally. These include OEM-installed telematics systems, aftermarket fleet trackers, insurance dongles, and V2X communication modules. Most new cars globally, especially in developed markets, now ship with embedded connectivity.

In the U.S., where usage-based insurance and fleet compliance regulations are mature, vehicle telematics is deeply entrenched. Public transportation systems also use IoT for routing and maintenance analytics. The rise of EVs and autonomous vehicles is further amplifying connected car deployments.

7. Energy/Oil & Gas – 1.0 Billion Devices Globally | 0.26 Billion in the U.S.

While smaller in volume, the **energy sector** represents a high-value IoT vertical with over **1 billion devices** globally. This includes smart meters, SCADA systems, leak detectors, and substation sensors. The segment is vital for grid modernization, renewables integration, and asset protection.

The U.S. utilities sector has seen strong adoption of smart meters (72% penetration) and IoT-based fault detection in substations. In oil & gas, pipeline sensors, gas leak detectors, and pump monitors are widely used to reduce downtime and ensure safety, especially in states like Texas and Alaska.

The 2025 IoT device landscape reflects a highly diversified ecosystem, with each application area scaling based on its unique drivers—from safety and operational efficiency to regulatory mandates and customer expectations. Security and surveillance dominate by volume, but other domains like industrial automation, asset tracking, and remote monitoring show strong momentum. As 5G, LPWAN, and AI technologies evolve, the IoT footprint will continue to expand, offering significant opportunities for innovation and monetization across sectors.

1.12. Global Blockchain Market

1.12.1. Market Landscape and Key Trends

Blockchain technology has rapidly evolved from a niche concept to a mainstream component of digital transformation. Globally, the blockchain market has grown into a multi-billion dollar industry and continues to expand at an exponential rate. As of 2024, the global blockchain technology market was valued at US$ 25.9 billion. By the end of the decade, Frost & Sullivan estimates the global blockchain market to be US$ 398.1 billion.

Exhibit 63: Global Blockchain Market (USD Bn) - CY2020 – 2030F
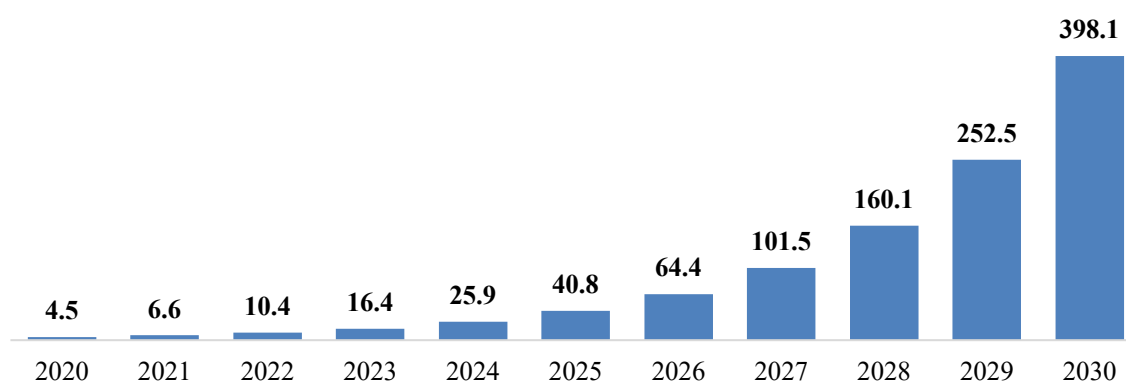
Source: Frost & Sullivan analysis

This explosive growth trajectory often with annual growth rates well above 50% reflects the high expectations for blockchain across various sectors. The market landscape is dynamic, characterized by increasing enterprise adoption, significant venture capital investment, and growing government interest. Currently, the banking and financial services industry (BFSI) accounts for one of the largest portions of blockchain spending globally, reflecting the technology's roots in financial applications. However, sectors such as manufacturing, logistics, retail, and government are quickly expanding their blockchain use, leading to a more diversified industry landscape. North America (led by the United States) currently accounts for the largest share of the global blockchain market, upwards of 30% of the total market, thanks to its strong technology ecosystem and early-mover advantage. However, adoption is truly worldwide: Europe and Asia-Pacific are also major contributors, with Asia (especially China, India, and Southeast Asia) rapidly increasing blockchain deployments. Many governments in Asia and Europe have launched national blockchain strategies or pilot programs, accelerating regional growth. Notably, China has made blockchain a part of its national strategy – investing in large-scale initiatives like a state-backed Blockchain Service Network and piloting a central bank digital currency (the digital yuan). Likewise, countries such as Switzerland, Singapore, and the UAE have positioned themselves as blockchain-friendly hubs by establishing clear regulations and welcoming crypto startups. These international developments mean that innovation is globally distributed, adding both competitive pressure and opportunities for cross-border collaboration in the blockchain market. Overall, the competitive landscape includes a mix of established tech giants and nimble startups building blockchain platforms, as well as consortiums formed by industry players to develop shared ledger solutions. At present, there are thousands of blockchain projects and

pilot programs active worldwide – some involving just a few firms internally, and others spanning entire industries with hundreds of participating organizations.

Business leaders are taking note of blockchain's potential. A large majority of enterprise executives now view blockchain as a strategic priority for their organizations and majority of them are actively planning or implementing blockchain solutions, and many expect blockchain to be part of their core technology stack. This shifting mindset in boardrooms and C-suites worldwide further validates the market's trajectory and encourages more investment into blockchain initiatives.

Key trends shaping the global blockchain market include:

Exhibit 64: Key trends for Global Blockchain Market

- **Enterprise and Consortium Adoption:** Businesses are moving beyond pilot projects into real deployments. Industry consortiums are forming to use shared blockchains for common challenges – for example, groups of banks collaborating on blockchain trade finance platforms, or logistics companies sharing shipping data via a blockchain network. (Examples include industry alliances like the Enterprise Ethereum Alliance, which brings together companies to develop enterprise-grade blockchain standards, and specialized consortia such as B3i in insurance or we.trade in banking that focus on collaborative blockchain solutions for their sectors.) This trend indicates blockchain becoming foundational infrastructure for multi-company processes, as multiple organizations band together to streamline workflows.
- **Digital Assets and Tokenization:** The financial sector is seeing rapid innovation through blockchain. Cryptocurrencies and stablecoins are one aspect, but beyond that, real-world asset tokenization is emerging as a game-changer. Companies and even governments are exploring tokenizing assets like real estate, commodities, and securities on blockchains to enable easier trading and liquidity. Decentralized finance (DeFi) platforms continue to evolve, offering services like lending, trading, and insurance without traditional intermediaries – which is pushing banks and financial institutions to adapt. Additionally, the concept of non-fungible tokens (NFTs) has expanded beyond digital art; businesses are now tokenizing everything from supply chain invoices to intellectual property, creating new markets for fractional ownership and exchange. All of these developments blur the line between traditional finance and digital asset markets, leading to new hybrid models of commerce.
- **Integration with Emerging Technologies:** Blockchain is increasingly integrated with other cutting-edge technologies. One example is the Internet of Things (IoT), where blockchain can securely log data from sensor networks and enable autonomous device-to-device transactions (for instance, in smart homes or factories). Another example is artificial intelligence (AI), which can leverage blockchain for trustworthy data sharing and for maintaining audit trails of AI decision-making processes. This convergence of technologies is creating new use cases such as smart contracts that automatically execute based on IoT

sensor data, or AI algorithms managing blockchain-based marketplaces of data or digital assets. It also means that the future digital infrastructure could be a blend of AI, IoT, and blockchain working together, each enhancing the capabilities of the other.

- **Regulatory Evolution and Government Use:** Around the world, regulators are developing clearer frameworks for blockchain and digital assets. This regulatory progress – from comprehensive cryptocurrency regulations in the European Union to discussions of stablecoin rules in the U.S. and new guidelines in markets like Singapore – is gradually reducing uncertainty for businesses and investors. (For instance, the European Union's adoption of clear rules such as the MiCA regulation for crypto-assets, and countries like Singapore establishing licensing regimes for crypto companies, have created safe harbors that attract blockchain ventures. This global shift in policy is putting pressure on other regions to modernize their regulations or risk losing innovative businesses to more welcoming jurisdictions.) Simultaneously, governments themselves are experimenting with blockchain for public services. A prominent area is Central Bank Digital Currencies (CBDCs), where dozens of central banks are piloting or launching digital versions of national currencies on distributed ledgers. Governments are also testing blockchain for things like land registries, voting systems, and transparent public procurement processes. These developments both legitimize the technology and open new markets (e.g., vendors providing blockchain solutions to governments).

- **Blockchain-as-a-Service (BaaS):** Major tech providers offer blockchain-as-a-service solutions that allow companies to adopt blockchain with reduced complexity. BaaS platforms let organizations spin up blockchain networks or smart contracts quickly without having to build infrastructure from scratch. This trend is lowering barriers to entry and accelerating enterprise adoption, especially for companies that lack in-house blockchain expertise. As a result, even smaller businesses or those outside the tech sphere can experiment with blockchain by leveraging cloud-based services and support. BaaS also encourages standardization and best practices, since many companies will use similar hosted platforms, thereby helping the overall ecosystem mature.

- **Focus on Sustainability and Scalability:** Early blockchains faced criticism for high energy usage (e.g. the electricity consumed by Bitcoin's proof-of-work mining) and for limited transaction throughput. In response, the industry is shifting towards more sustainable, efficient models. Many new blockchain protocols use energy-efficient consensus mechanisms (like proof-of-stake or variations of it) to drastically reduce environmental impact. Likewise, there is heavy R&D into scalability solutions – such as Layer 2 networks (off-chain processing layers) and interoperable chains – to handle larger transaction volumes at lower cost. These improvements (for example, Ethereum's recent upgrades significantly increasing transactions per second and cutting energy use by >99%) are making blockchain technology more practical for large-scale, real-time business applications. Sustainability has also become a selling point; companies adopting blockchain increasingly seek "green" blockchain options or carbon-neutral networks to align with corporate ESG goals.

- **Industry Consolidation and Collaboration:** As the blockchain sector matures, there is a notable rise in mergers, acquisitions, and strategic partnerships. Established corporations are acquiring blockchain-focused startups to quickly gain capabilities (for instance, major payment networks buying cryptocurrency custodians and analytics firms). At the same time, different blockchain platforms and communities are beginning to collaborate or interoperate rather than remain siloed. Competing enterprise blockchain consortia have started sharing lessons and even merging efforts in some cases. The recognition is that standardization and network effects are crucial for widespread adoption, multiple fragmented solutions won't survive long-term. This consolidation and cooperative trend points to a market evolving toward a few robust, interoperable ecosystems rather than many incompatible ones. It reflects a healthy maturation: larger players want to integrate blockchain tech, and smaller innovators often partner with or get absorbed by those players to scale up.

Collectively, these trends indicate that blockchain is maturing. It is transitioning from the hype phase into a phase of practical utility, where the emphasis is on solving real business problems and integrating within the existing digital ecosystem.

Stakeholders

The global blockchain ecosystem involves a diverse set of stakeholders, each playing a role in the technology's development and adoption:

Exhibit 65: Stakeholders of Global Blockchain Ecosystem
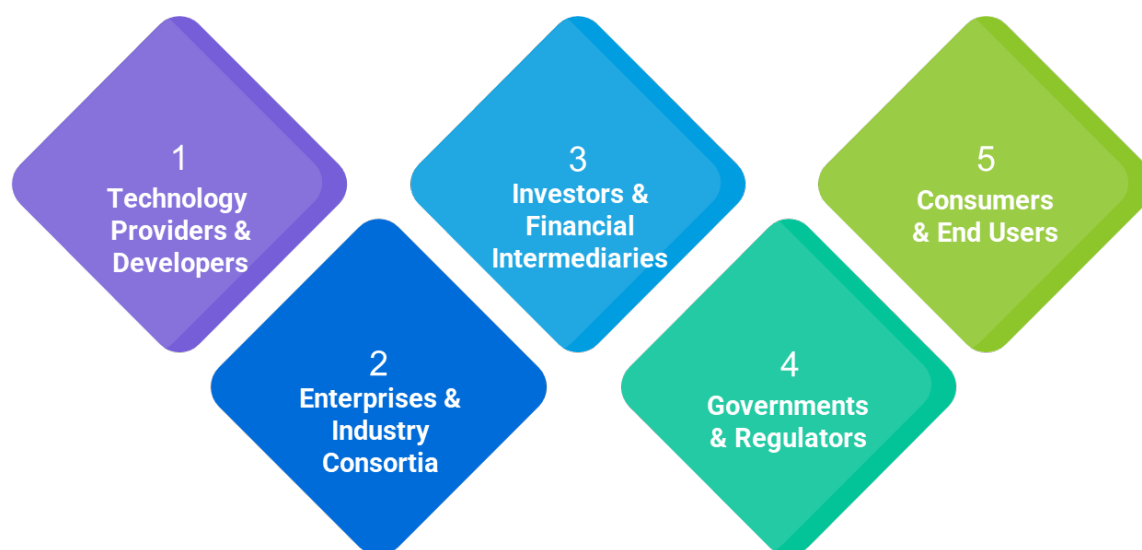
- Technology Providers & Developers: Cloud giants plus hundreds of specialist start-ups and open-source communities (Ethereum, Hyperledger, Solana) supply the core platforms, permissioned frameworks, and developer tools that power enterprise ledgers and dApps (decentralized applications, that run on a blockchain or decentralized network rather than on centralized servers, using smart contracts to automate and enforce rules without intermediaries). Their value lies in constant upgrades—better privacy, throughput, compliance modules—and in integration services that stitch blockchain into legacy IT.
- Enterprises & Industry Consortia: Banks, insurers, manufacturers, shippers, retailers, healthcare networks, and energy firms pilot or scale blockchains to cut reconciliation costs and co-manage shared data. Sector alliances (e.g., Enterprise Ethereum Alliance, B3i, we.trade) pool expertise and agree common standards, accelerating production roll-outs while spreading implementation risk.
- Investors & Financial Intermediaries: Venture capital, hedge funds, and token investors inject billions into blockchain start-ups, pushing rapid product iteration and lofty valuations. Traditional exchanges and asset managers likewise build tokenised-asset rails and crypto-linked instruments, bringing institutional credibility and deep liquidity to the ecosystem.
- Governments & Regulators: Policy makers shape the market through licensing regimes, tax codes, AML/KYC rules, and pilot funding. Clear, balanced guidance (e.g., on stablecoins or smart-contract legality) unlocks enterprise budgets; uncertainty or over-reach stalls projects. Public agencies themselves emerge as marquee users—land registries, customs, and defense provenance being early examples.
- Consumers & End-Users: Millions now hold crypto, trade NFTs, or use DeFi apps—creating grassroots demand for secure, low-friction services. Their adoption triggers network effects that pull enterprises and regulators along; conversely, poor UX or trust breaches can kill traction. End-user value—speed, transparency, authenticity—ultimately determines which blockchain offerings win.

Each of these stakeholders has a vested interest in the growth of blockchain technology and often collaborates with others to drive the ecosystem forward. The interplay between tech developers, industry adopters, regulators, investors, and users determines how quickly and broadly blockchain solutions scale up globally.

Key Applications and Use Cases

Blockchain's core strengths – decentralization, immutability, and transparency – lend themselves to a wide range of applications. Some of the most impactful use cases in the global market currently include:

Exhibit 66: Key Applications & Use Cases of Blockchain

1. **Supply Chain Management**

2. **Financial Services**

3. **Automotive Industry**

4. **Manufacturing & Industrial**

5. **Other Emerging Use Cases**
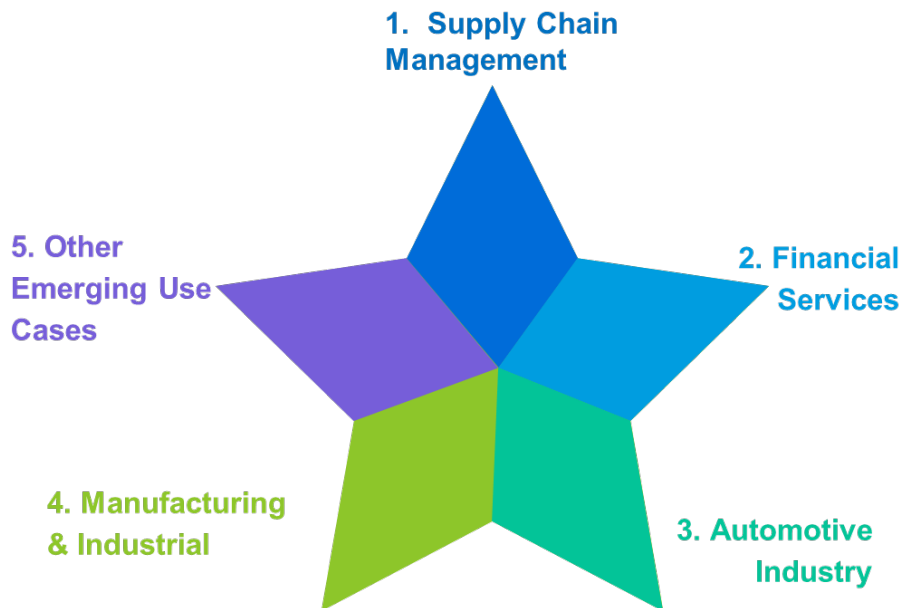
- **Supply Chain Management:** Supply chains involve multiple parties (suppliers, manufacturers, distributors, retailers) and often suffer from a lack of transparency or trust among participants. Blockchain is being used to create tamper-proof, shared records of transactions and shipments, enabling end-to-end traceability of goods. This has enormous benefits: for instance, a retailer can verify the origin and journey of a food product within seconds, helping quickly pinpoint contamination sources during a recall. Likewise, in global freight transport, digitizing paperwork (such as bills of lading and customs forms) on a blockchain allows shipping lines, ports, and customs authorities to share a single source of truth for cargo, cutting down administrative delays. Major ocean carriers have reported that such blockchain-based systems can reduce transit times by as much as 40% in busy trade lanes, due to faster document processing and fewer disputes. Provenance tracking is valuable not only for food safety but also for pharmaceuticals (to ensure drugs are authentic and safe), luxury goods (to combat counterfeiting by verifying each item's authenticity), and critical manufacturing parts (to quickly trace defects). By having an immutable log of each step of a product's lifecycle, companies can reduce fraud, prevent gray-market diversions, and increase efficiency in inventory management. Moreover, the drive for more resilient supply chains (especially after recent global disruptions) has accelerated interest in blockchain as a tool to improve visibility and agility. Blockchain-based supply chain solutions are already in use in agriculture, mining (e.g. tracing diamonds or rare minerals ethically), fashion, and more – often in combination with IoT sensors that feed real-time data (such as temperature or location) into the blockchain record.

- **Financial Services:** The finance sector was one of the earliest adopters of blockchain, beginning with cryptocurrencies and now expanding into broader applications. Today, blockchain is transforming financial services in several ways. Cross-border payments and remittances are being streamlined through blockchain networks that settle transactions in minutes or seconds with lower fees, bypassing the slow traditional correspondent banking routes. Large banks and fintech companies are using blockchain for interbank payments and clearing – for example, to move funds between branches or partner institutions more efficiently, or to enable 24/7 cross-border currency transfers that were not possible through legacy systems. Trade finance is another area seeing change: traditionally paper-intensive processes (like letters of credit, invoice factoring, or supply chain financing) are being digitized on blockchain platforms, allowing multiple parties (exporters, importers, shipping companies, banks, insurers) to share data and verify documents securely, thus reducing paperwork delays and fraud. Additionally, the capital markets are exploring blockchain for issuing and managing securities: there have been successful pilots of issuing digital bonds or equities on blockchains, which enable instantaneous settlement and continuous tracking of ownership (reducing the need for intermediaries like clearinghouses). Beyond traditional institutions, the rise of decentralized finance (DeFi) – mostly built on public blockchain networks – has demonstrated new

financial products such as automated lending, decentralized exchanges (DEXs), and algorithmic stablecoins, which operate without central intermediaries. While DeFi primarily exists in the crypto-asset realm, its innovations (like smart contracts enabling liquidity pools and yield farming) are influencing mainstream finance and prompting incumbents to consider how to incorporate blockchain-based services. Overall, the use of blockchain in finance aims to increase speed, reduce overhead costs, and enhance security and transparency, ultimately expanding access to financial services on a global scale.

- **Automotive Industry:** The automotive sector is leveraging blockchain in both its supply chain and its emerging mobility services. In manufacturing, automakers are using blockchain ledgers to track the provenance and movement of auto parts from suppliers through assembly and out to dealerships. This granular tracking helps with quality control and safety recalls; for example, if a defective component is discovered, a blockchain record can immediately identify which batch of vehicles received that part and who supplied it, enabling targeted recalls much faster than traditional methods. Blockchain is also employed to combat counterfeit parts – a significant issue in the automotive aftermarket – by providing a verifiable history for each genuine component and validating that repairs use authorized parts. Beyond the factory, blockchain supports new automotive business models as vehicles become more connected and services-oriented. For instance, secure blockchain networks can record vehicle usage data for car-sharing or rental services, ensuring accurate records of mileage and maintenance that all parties (owners, users, service centers) trust. Some projects are exploring blockchain for managing electric vehicle charging and energy transactions, where cars, charging stations, and electric utilities securely exchange information and payments (potentially enabling peer-to-peer energy selling or automated billing for charging sessions). Additionally, automotive finance and insurance processes benefit from blockchain: a car's ownership history, accident records, and insurance claims could be maintained on a shared ledger, simplifying title transfers and speeding up insurance payouts through smart contracts when certain conditions are met. While many of these applications are still in early stages, the automotive industry sees blockchain as a tool to increase trust, safety, and efficiency in a rapidly evolving ecosystem of manufacturers, service providers, and customers.

- **Manufacturing and Industrial:** In the broader manufacturing sector, blockchain is enhancing transparency and coordination across complex industrial supply networks. Manufacturers often work with hundreds of suppliers and partners; a blockchain-based system allows all parties to log production updates, shipments, and quality checks on a common, secure ledger. This shared visibility reduces errors and delays. For example, a large industrial manufacturer can monitor in real-time that a component produced in one country has passed quality inspection and is en route to its assembly plant in another country – all recorded on a blockchain where it cannot be tampered with. Blockchain is also used for maintenance and warranty management. By recording equipment maintenance history or product service records on a blockchain, companies ensure that this data is trustworthy and accessible to whoever needs it (such as a new owner of a machine or an auditor checking compliance). In sectors like aerospace or electronics, where safety and regulatory compliance are critical, having an immutable record of every part's origin and inspection can dramatically streamline audits and improve safety outcomes. Another manufacturing use case is automated reconciliation and financing: for instance, when a supplier delivers goods to a manufacturer, that event can be logged on a blockchain visible to the supplier's bank, triggering a smart contract that automatically releases a payment or a short-term loan to the supplier. This kind of integration between supply chain events and financial services (sometimes called "supply chain finance") reduces administrative overhead and speeds up cash flow, benefiting especially small suppliers. In summary, blockchain is driving the industrial sector toward more synchronized, transparent operations with less friction in multi-party collaborations.

- **Other Emerging Use Cases:** Beyond the major sectors above, blockchain is being applied in many other domains. For example, in healthcare, hospitals and clinics are testing blockchain to securely share and manage patient health records, improving data interoperability and patient privacy. In the public sector, blockchain is being piloted for uses like digital identity verification (creating tamper-proof personal IDs) and even voting systems, with the aim of enhancing security and trust in elections. The media and entertainment industry is exploring blockchain for rights management and royalty distribution, allowing artists and content creators to get paid more transparently (for instance, via music NFTs or blockchain-

based streaming platforms). Even education credentials, real estate transactions, and charitable donations are areas where blockchain-based solutions are emerging, underscoring the technology's versatile potential across the economy.

Market Drivers and Opportunities

Several key drivers are propelling the global growth of blockchain technology, creating substantial opportunities:

Exhibit 67: Drivers for Global Blockchain Technology
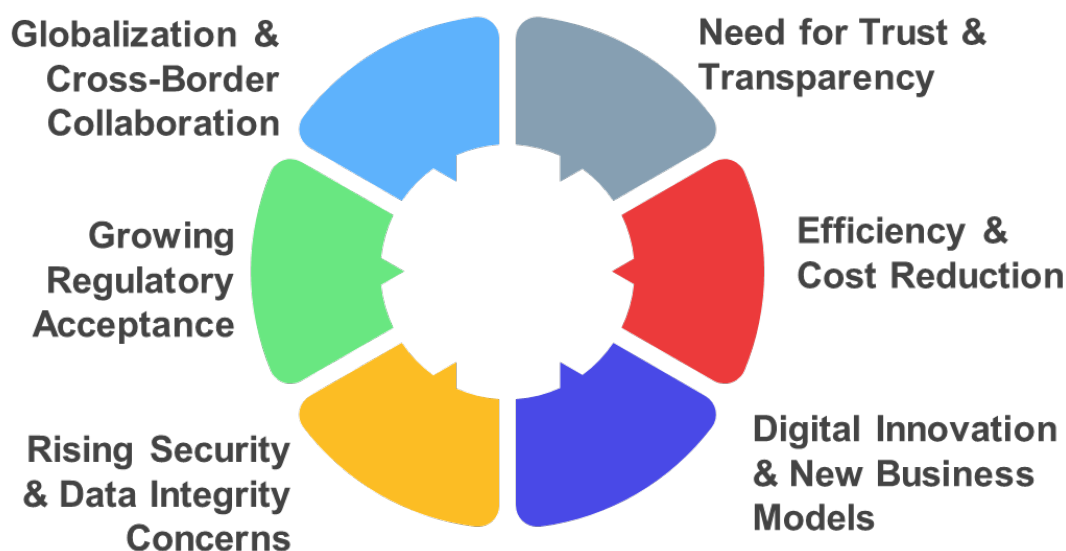
- **Need for Trust and Transparency:** Across industries, there is a heightened demand for systems that can establish trust among parties who may not fully trust each other. Blockchain's ability to provide a single source of truth – where data is transparent and verifiable yet also secure and tamper-proof – directly addresses this need. This is a major driver in sectors like supply chain (where buyers want transparency into provenance and compliance of goods) and finance (where secure, auditable transactions are critical). Organizations see blockchain as a way to reduce fraud, errors, and disputes because all participants share the same immutable data. The opportunity lies in replacing or enhancing legacy record-keeping and transaction networks with blockchain to improve integrity and accountability. Companies that provide trust-enhancing blockchain solutions (for example, platforms for verifying product authenticity or tracking transactions) stand to gain significant adoption.
- **Efficiency and Cost Reduction:** Companies and governments are continually seeking ways to streamline processes and cut costs. Blockchain, especially when combined with smart contracts, can automate workflows that currently require intermediaries or cumbersome manual paperwork. By cutting out middlemen, reducing reconciliation tasks, and speeding up transaction settlements, blockchain solutions can save time and money. For example, a cross-border transaction that traditionally takes several days and incurs high fees can be completed in minutes on a blockchain at a much lower cost. These kinds of improvements drive adoption as organizations see clear ROI in areas like reduced administrative overhead, faster settlement times, and fewer errors. The opportunity for innovators is to target inefficient processes in big industries (finance, supply chain, real estate, etc.) and offer blockchain platforms that provide a more efficient alternative. Early movers that establish cost-saving networks can attract a critical mass of users, creating network effects that make their solution the go-to standard.
- **Digital Innovation and New Business Models:** The advent of blockchain has enabled entirely new products and services – from digital currencies and tokens to decentralized applications that operate on smart contracts. This wave of innovation is a driver in itself: businesses are investing in blockchain to avoid missing out on the next big digital platform. Tokenization of real-world assets is one such opportunity, allowing fractional ownership and new liquidity for assets (e.g., tokenized real estate that can be traded like stocks, or carbon credits tokenized for easier exchange). Similarly, micro-payment systems powered by blockchain, content monetization via tokens, and peer-to-peer marketplaces are emerging business

models that were not feasible before. The lure of creating new revenue streams and disrupting traditional markets motivates companies to explore blockchain. For instance, the rise of non-fungible tokens (NFTs) has allowed creators and brands to monetize digital content and collectibles in novel ways, illustrating how blockchain opens up business opportunities previously not possible. Investors see a long-term opportunity in backing the "picks and shovels" of this digital gold rush – that is, the platforms and exchanges that could become the future leaders of a decentralized internet (often referred to as Web3).

- **Rising Security and Data Integrity Concerns:** In an era of frequent data breaches and cyberattacks, blockchain's security features (encryption, decentralization, and immutable audit trails) are highly attractive. Enterprises are driven to consider blockchain for improving data integrity and preventing unauthorized tampering of records. For instance, critical infrastructure operators or healthcare providers might use blockchain to ensure that sensitive data (like equipment maintenance logs or patient records) cannot be altered surreptitiously, and that any access is transparently logged. While blockchain is not a cure-all for cybersecurity, its unique properties offer a new approach to securing multi-party data sharing. This creates opportunities for solutions that leverage blockchain as part of a broader security architecture, appealing to any sector where data assurance is paramount. Companies providing blockchain-based identity management, secure information exchange platforms, or tamper-proof audit systems are seeing growing interest. In the long run, as businesses increasingly treat data as a critical asset, technologies that guarantee data integrity (like blockchain) become essential.

- **Growing Regulatory Acceptance:** Initially, regulatory uncertainty was a barrier for blockchain and especially cryptocurrency-related applications. Now, we see a gradual shift – many governments and international regulators have recognized the potential benefits and are crafting guidelines to safely integrate blockchain into the economy. This can be a driver because clarity in regulations (such as legally recognizing blockchain records and smart contracts, or providing licenses for crypto service providers) gives businesses confidence to invest. For instance, the European Union's comprehensive framework (MiCA) and similar efforts in other jurisdictions are laying down rules of the road. Additionally, government-led blockchain projects (like pilot programs for digital currencies or public-sector blockchain platforms) can jumpstart local markets by demonstrating viability. The opportunity here is twofold: companies that navigate compliance well can become leaders in regulated blockchain services (such as exchanges or digital asset custody), and early movers can help shape standards in their favor. Furthermore, as regulation normalizes the blockchain space, more institutional capital (which tends to wait for clear rules) will enter the market, expanding opportunities for funding and partnerships.

- **Globalization and Cross-Border Collaboration:** Modern business is inherently global, and blockchain's borderless nature is tailor-made for cross-border transactions and multi-country consortiums. The need to collaborate across geographies – whether to manage a global supply chain or settle international financial transactions – is a driver for blockchain adoption, since it provides a neutral, shared platform not controlled by any single country or company. Blockchain can bypass many inefficiencies of coordinating across different systems and jurisdictions. For example, in trade finance, banks and trading partners from different countries can use a shared blockchain to approve and track transactions simultaneously rather than exchanging physical documents, drastically cutting processing time and errors. Similarly, international payment networks built on blockchain bypass multiple correspondent banks, enabling near-instant settlement of cross-border remittances. The addressable market for these cross-border applications is enormous, and companies that succeed here could tap into a truly global user base. The opportunity is especially ripe for platforms that connect businesses across continents – such as global trade documentation ledgers or worldwide supply chain visibility tools – where no single existing entity currently provides a trusted, unified solution. Blockchain's inherent internationalism gives it an edge in solving these problems.

The global blockchain market's expansion is fueled by a combination of technological advantages and pressing market needs. The opportunity for growth is significant – not just within the tech industry itself, but across all industries that blockchain can transform. For investors, this translates to a broad array of potential investment areas, from enterprise software providers and infrastructure builders to industry-specific blockchain applications and the startups driving innovation in these spaces.

1.12.2. U.S. Blockchain Market

Market Landscape and Key Trends in the U.S.

The United States is one of the pivotal markets for blockchain technology, both in terms of innovation and adoption. As of the mid-2020s, the U.S. has a substantial share of global blockchain activity – by itself comprising a large portion of the North American market, which is the leading region worldwide. The U.S. hosts a significant number of blockchain-focused companies and is home to many of the world's largest technology and financial firms that are actively exploring blockchain solutions. The U.S. blockchain market itself is expected to expand dramatically. As per Frost & Sullivan estimates, the US blockchain market was valued at US$ 0.9 billion in 2020, and US$ 6.2 billion in 2024. As per Frost and Sullivan estimates, the blockchain market in US is expected to reach US$ 109.5 billion by 2030 growing at a CAGR of 60.7% in the 2025-2030 period.

Exhibit 68: US Blockchain Market (USD Bn) - CY2020 – 2030F

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1.39	2.29	3.78	6.21	10.20	16.42	26.39	42.42	68.16	109.49
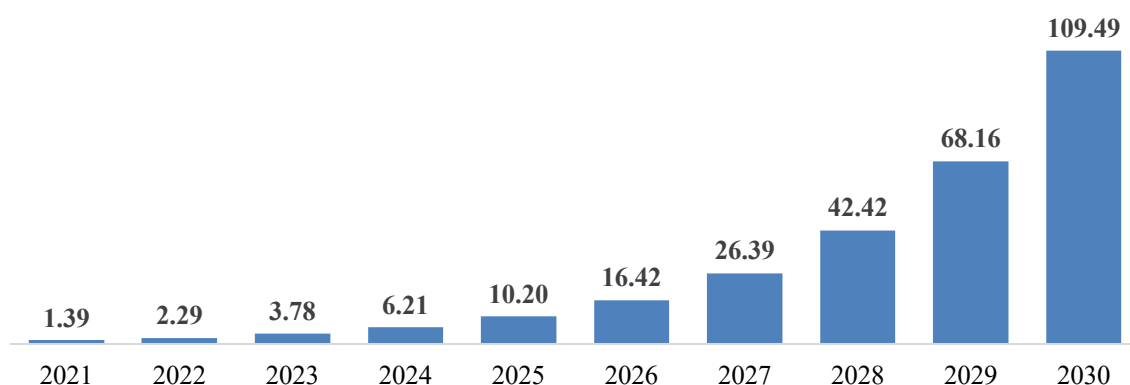
Source: Frost & Sullivan analysis

This trend reflects both domestic adoption and the U.S. influence on the global stage of blockchain development. The market landscape in the U.S. is marked by both enthusiasm and caution. On one hand, private-sector investment in blockchain and digital assets remains high. Financial centers like New York and tech hubs like Silicon Valley are seeing continuous development of projects ranging from fintech applications to supply chain pilots. Many U.S. multinational corporations across industries have established blockchain teams or partnerships to implement the technology in various facets of their operations. On the other hand, regulatory uncertainty especially around cryptocurrencies and certain token-based ventures has at times tempered the pace of adoption. U.S. regulators such as the Securities and Exchange Commission (SEC) and Commodity Futures Trading Commission (CFTC) have increased scrutiny on crypto assets and blockchain-related offerings, creating a complex environment for businesses to navigate. Nonetheless, the regulatory landscape is gradually evolving, and there are ongoing efforts in the U.S. Congress and state legislatures to provide clearer legal frameworks for blockchain and digital assets. The expectation in industry is that as rules become defined, a new wave of institutional and enterprise adoption will follow.

Key trends in the U.S. blockchain market include:

Exhibit 69: Trends in US Blockchain Market

1. Regulatory Clarification Efforts
2. Institutional & Enterprise Adoption
3. Integration with Legacy Infrastructure
4. Public Sector Participation
5. Thriving Startup & Talent Ecosystem
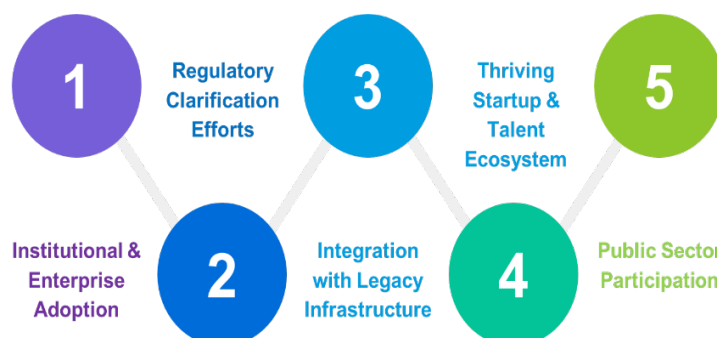
- Institutional & Enterprise Adoption – U.S. megabanks and Fortune 500s (e.g., Walmart food-chain ledger) now run production blockchains for payments, settlement and traceability. Each new success story triggers a "follow-the-leader" effect, making distributed ledgers a routine enterprise tool rather than an experiment.
- Regulatory Clarification Efforts – Capitol Hill and statehouses are edging toward firm rules (Digital Commodity Exchange Act, DAO LLC statutes in Wyoming, first Bitcoin ETFs, etc.). Although supervision is strict, clearer guidance is steadily lowering compliance risk and unlocking bigger institutional budgets.
- Integration with Legacy Infrastructure – U.S. players favour bolt-on ledgers that upgrade existing rails (DTCC's Project Ion parallel settlement layer, blockchain bills-of-lading tied to port software). This incremental path delivers quick ROI and keeps regulators comfortable, accelerating real-world deployments.
- Thriving Startup & Talent Ecosystem – Coastal and heartland hubs host thousands of blockchain start-ups, fueled by active VC pipelines, university research labs and rising demand for blockchain developers. Continuous protocol breakthroughs (scalability, privacy, interoperability) keep the U.S. at the forefront of technical innovation.
- Public-Sector Participation – Federal and state agencies pilot ledgers for pharma tracking (FDA), defense logistics, grid management (DoE) and even overseas voting. Successful pilots could scale into nation-wide systems—creating sizable contracts for vendors and signalling mainstream legitimacy for the technology.

Overall, the U.S. blockchain market exhibits a mix of mature initiatives by established firms and disruptive innovation by startups, all unfolding under the watchful eye of regulators. The United States remains a critical arena for blockchain development and deployment. Successes or setbacks in this market often influence perceptions and strategies in other countries, given the outsized role of the U.S. in global finance and tech. In many ways, the U.S. is setting precedents (in regulation, enterprise integration, and consumer adoption) that will shape the worldwide evolution of blockchain technology.

Stakeholders in the U.S. Market

The stakeholder landscape in the United States blockchain market mirrors the global scene in many respects, with some notable U.S.-specific highlights:

- Technology & Service Providers – U.S. cloud giants and crypto-native firms supply platforms, SaaS tool-kits and consulting that turn blockchain into an off-the-shelf capability. A vibrant start-up scene delivers next-gen protocols and partners with majors to reach enterprises.
- Enterprises & Corporate Adopters – Banks, insurers, retailers, manufacturers, energy and healthcare leaders deploy ledgers for faster settlement, provenance and compliance. Participation in consortia such as R3 Corda or Walmart-led food-trace projects sets de-facto standards and creates "follow-on" pressure across sectors.
- Investors & Venture Capital – Silicon Valley VCs, Wall-Street venture arms and crypto-specialist funds pump billions into U.S. blockchain start-ups, while several players list on public exchanges. Capital abundance accelerates scaling and signals long-term profit potential.
- Regulators & Policy Makers – A multi-agency mix (SEC, CFTC, Fed, OCC, state bodies) is shaping rules on tokens, custody and AML. Gradual clarity—e.g., Wyoming DAO LLCs, pending stable-coin bills— aims to balance consumer protection with innovation, heavily influencing market pace.
- End Users & Clients – Tech-savvy U.S. consumers trade crypto, scan provenance QR codes and expect digital-currency options, while corporate customers demand seamless, transparent services. Their adoption and UX feedback ultimately decide which blockchain offerings achieve scale.

These stakeholders in the U.S. create a robust and interdependent ecosystem. Their interactions – tech companies providing infrastructure, enterprises piloting and scaling solutions, investors funding innovation, regulators setting boundaries, and users adopting (or rejecting) new services – collectively shape the trajectory of the blockchain market in America. Success in the U.S. often requires navigating the concerns and expectations of all these groups.

Key Applications and Use Cases in the U.S.

The primary use cases for blockchain in the United States closely align with global trends, with particularly strong representation in finance and supply chain domains, among others. Notable U.S. examples include:

Exhibit 70: Key Applications & Use Cases Blockchain in US

- **Supply Chain and Logistics:** American companies have been leaders in applying blockchain to supply chain challenges. In the food industry, Walmart's blockchain-based food traceability system (developed in partnership with IBM) originated in the U.S. and has dramatically improved tracking speed for produce and other products. What used to take Walmart days of manual effort to trace (for example, tracing a package of mangoes back to the farm) can now be done in seconds on the blockchain, enhancing food safety and inventory management. Likewise, Walmart Canada has used blockchain to solve a logistics nightmare in freight invoicing: by having truckers and the company share a blockchain ledger of deliveries and approvals, they virtually eliminated invoice disputes and paperwork delays with their carriers. Beyond retail, U.S. pharmaceutical supply chains have been a focus due to regulatory requirements (the Drug Supply Chain Security Act mandates full traceability by 2023); leading companies like Pfizer and Merck to participate in blockchain pilots that trace medications from manufacture to pharmacy, improving patient safety by quickly detecting counterfeit or recalled drugs. Major ports such as the Port of Los Angeles have trialled blockchain platforms to coordinate shipping data among port operators, trucking companies, customs, and importers, which speeds up container clearance and reduces congestion. These examples highlight how across sectors from agriculture and food to pharmaceuticals and imported goods, blockchain is being implemented to increase transparency, reduce paperwork, and quickly flag any issues. American businesses value the resiliency and trust that blockchain can add to supply chains, especially after seeing disruptions in recent years, and this is driving further adoption.
- **Financial Services and Banking:** The U.S. financial sector is at the forefront of blockchain integration. Nearly all major American banks and many fintech companies are exploring or implementing blockchain in some form. A prominent area is payments and settlements – for instance, a consortium of U.S. banks launched the USC (Utility Settlement Coin) initiative (now called Fnality in global contexts) to use tokenized cash for interbank settlements, and the Federal Reserve has been researching the concept of a digital dollar (a CBDC) to modernize the U.S. dollar's infrastructure. Capital markets are also seeing blockchain influence: Nasdaq and the New York Stock Exchange have invested in blockchain startups and ran trials for using blockchain in private market trading and proxy voting. The custody and asset management space has made strides, with firms like BNY Mellon and Fidelity introducing digital asset custody services for institutional clients, acknowledging the growing demand to hold crypto assets safely. Payment giants have integrated cryptocurrency capabilities (such as allowing spending of crypto at merchants or settling transactions via stablecoins) into their networks, effectively blending blockchain-based currency with traditional payment rails. Additionally, the U.S. is a major hub for crypto trading

platforms and decentralized finance development (the core teams of leading DeFi protocols such as Uniswap or Aave have a U.S. presence or significant user base). For American consumers, this translates into more options: they can invest in digital assets through regulated platforms, use stablecoins for quick transfers, or even take out crypto-backed loans – services that barely existed a few years ago. In summary, from Wall Street to Silicon Valley, blockchain is being used to make financial transactions faster, more accessible, and more programmable. The U.S. financial industry's adoption not only improves efficiency domestically but also helps shape global standards (given New York's influence in finance), reinforcing the U.S. position as a leader in fintech innovation.

- **Automotive and Mobility:** The U.S. automotive industry, including both traditional manufacturers and new mobility startups, is adopting blockchain to enhance operations and services. Leading U.S. carmakers have explored blockchain for supply chain tracking – ensuring that each component (from microchips to airbags) can be traced to its source. This capability is crucial for managing recalls efficiently: if a batch of parts is found defective, blockchain records can instantly show which vehicles and dealers received those parts, focusing the recall effort and reducing investigation time. Another area is vehicle history and ownership: states like California and Vermont have studied using blockchain for digital vehicle titles to simplify transfers and reduce title fraud. In a blockchain-based title system, when a car is sold, the title change could be securely recorded on a ledger accessible to DMV, insurance companies, and buyers, streamlining what is currently a paperwork-heavy process. The concept of mobility as a service also benefits – for example, startups have built blockchain platforms where car owners can rent out their vehicles on a secure network, with smart contracts handling usage agreements and payments (ensuring that mileage and return condition are logged indelibly). In the realm of electric vehicles (EVs) and smart infrastructure, pilot projects in the U.S. are looking at how EVs could automatically transact with charging stations (paying in crypto or tokens per kilowatt) and even trade electricity back to the grid, all coordinated by blockchain for trust. The Mobility Open Blockchain Initiative (MOBI), which counts U.S. automakers and tech firms as members, is working on standards for blockchain use in auto applications like vehicle identity (each car having a digital ID on blockchain) and usage-based insurance (where driving data recorded on blockchain triggers insurance smart contracts). These efforts show that whether it's manufacturing, sales, or new mobility services, blockchain is gradually becoming part of the automotive landscape in America, aiming to make it more efficient and customer-centric.

- **Manufacturing and Aerospace:** U.S. manufacturing giants and aerospace/defense companies are employing blockchain for improved supply chain security and operational efficiency. In aerospace, companies have shown interest in blockchain to track parts and certifications throughout an aircraft's lifecycle. With the enormous number of components in planes and the strict regulations for maintenance, an immutable ledger of parts (who manufactured them, when they were installed, how long they've been in use) can simplify compliance and safety checks. It also helps in preventing counterfeit or sub-standard parts from entering the supply chain - an important issue in defense procurement. In the electronics and high-tech manufacturing sector (which has a strong base in the U.S.), firms are using blockchain to ensure the authenticity of components (for example, verifying that chips or sensors are from authorized sources) and to monitor their journey through assembly. On the factory floor, industrial IoT devices combined with blockchain are improving quality assurance; sensors can record machine readings or environmental conditions during production directly onto a blockchain, creating a trusted audit trail of how a product was made. This is useful for proving that standards were met (say, temperature remained within a certain range during drug production) without relying on siloed databases that could be altered. Another use in U.S. manufacturing is streamlining supplier payments and financing – as seen in global cases, American manufacturers are adopting platforms where when goods are delivered and logged on a blockchain, it triggers automatic payment or financing from banks, reducing the wait for suppliers to get paid. This is especially beneficial for the many small manufacturing suppliers in the U.S. who depend on quick turnaround of invoices. From the factory to the field, these applications show blockchain helping U.S. manufacturers and aerospace firms increase trust, reduce waste, and maintain a competitive edge in producing high-quality products.

- **Other Notable Applications:** Similarly to the global landscape, the United States is seeing blockchain experiments in various emerging areas. Several U.S. states have been active in exploring blockchain for

public services; for instance, Wyoming has pioneered laws to recognize blockchain records and even allow companies to be incorporated as decentralized autonomous organizations (DAOs), and some local governments are testing blockchain for managing land title registries and vital records. In real estate, there have been instances of property being transacted via blockchain tokenization or even sold as NFTs, demonstrating a potential shift in how assets might be exchanged in the future. In the energy sector, pilot projects in places like Texas and California are examining blockchain for peer-to-peer energy trading and tracking renewable energy credits among consumers. These examples highlight that beyond the primary use cases, the U.S. market is fertile ground for a wide range of blockchain innovations.

Market Drivers and Opportunities in the U.S.

The growth of the blockchain market in the United States is influenced by several drivers and presents distinct opportunities:

Exhibit 71: Drivers & Opportunities for US Blockchain Market
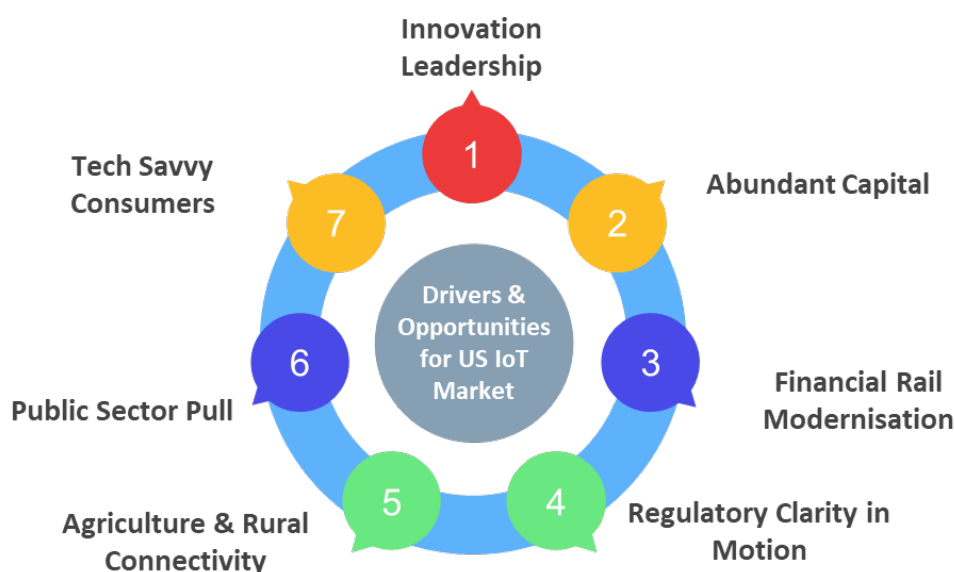
- Innovation Leadership – America's deep pool of researchers, engineers and entrepreneurs keeps it at the cutting-edge of cryptography and distributed-system design. Setting global standards first lets U.S. firms export platforms and shape interoperability, capturing outsized value—much as they did with the internet.
- Abundant Capital – Silicon-Valley VCs, Wall-Street funds and open public markets funnel billions into blockchain start-ups and listed players, giving them runway to build enterprise-grade products and dominate early niches. Investors gain privileged access to high-growth assets; the economy gains jobs and novel business models.
- Financial-Rail Modernisation – Outdated U.S. payment, settlement and remittance systems are ripe for T+0, 24/7 blockchain rails. Instant securities clearing or inclusive mobile wallets for the under-banked promise huge cost cuts and reinforce the dollar's global primacy rewarding firms that deliver compliant solutions first.
- Regulatory Clarity in Motion – Though still evolving, OCC crypto-custody guidance, proposed stable-coin bills and state-level statutes (e.g., Wyoming DAO LLCs) signal a shift from uncertainty to codified rules. Once frameworks solidify, institutional money and Fortune-500 adoption can scale rapidly; early compliant providers will enjoy first-mover advantage.
- Enterprise Efficiency & Security Demands – U.S. corporations pursuing digital-transformation see blockchain as a route to slash multi-party process costs, cut fraud and assure data integrity. Vendors who deliver turnkey, ROI-proven ledgers for supply-chain, insurance or health records stand to win fast-follower adoption across industries.

- Public-Sector Pull – Federal and state pilots—from FDA drug traceability to DoE smart-grid grants— legitimise the tech and create large reference deployments. Winning government contracts sets vendors up as trusted standards-bearers and accelerates private-sector uptake.
- Tech-Savvy Consumers – High U.S. crypto trading, NFT activity and demand for transparent products create a receptive market for blockchain-based services. Successful consumer apps (e.g., crypto rewards, provenance QR codes) spur competitors to match features, pulling the entire ecosystem into mainstream use.

The U.S. blockchain market is driven by a mix of innovation, investment, and the pursuit of competitive advantage, all underpinned by gradual moves toward regulatory clarity. The opportunities for growth in the U.S. are immense given the country's economic size, vibrant tech culture, and influence on global business practices. Companies and investors that navigate the U.S. landscape successfully stand to benefit not only domestically but can also leverage that success globally, as the U.S. often sets the pace in technology adoption and market trends.

Blockchain has evolved from experimentation to a key strategic technology in business and investment planning. Globally and in the U.S., it's entering a phase of broader adoption, with use cases proving value across industries— from supply chains to finance. Investors are eyeing opportunities in both core infrastructure and companies leveraging blockchain for competitive advantage. While challenges like regulation and scalability remain, blockchain is increasingly viewed as foundational to the digital economy—much like the internet in the 1990s. As adoption accelerates, organizations that fail to engage risk falling behind in the next wave of digital transformation.

1.13. Regional Blockchain Market Overview

1.13.1. India Blockchain Market Overview

India has emerged as a fast-growing hub for enterprise blockchain innovation in the Asia-Pacific. The government's proactive stance is a key driver. The Ministry of Electronics and IT (MeitY) released a National Blockchain Strategy to integrate blockchain into e-governance, aiming to create trusted digital platforms for citizens and businesses. The Reserve Bank of India's digital rupee (CBDC) pilot indicates a positive shift in official attitudes toward blockchain, signaling promise for blockchain in finance. The National Informatics Centre is even offering Blockchain-as-a-Service (BaaS) to government departments, making it easier to host blockchain applications and streamline public services. Such initiatives reflect India's commitment to using blockchain for improving transparency and efficiency in government and finance.

The private sector in India is also embracing blockchain for operational improvement. Major banks like ICICI and Axis use blockchain networks to secure and speed up transactions, especially in trade finance. Industrial and tech giants are experimenting in supply chain and logistics, for example, Tata Consultancy Services and the Mahindra Group are developing blockchain solutions for supply chain management. This is significant in a country with vast agricultural and retail supply chains, as blockchain can help farmers and retailers achieve end-to-end transparency in the food supply, reducing waste and fraud. India's vibrant startup ecosystem adds to these trends; homegrown projects such as Polygon (a blockchain scalability platform) have gained global recognition, highlighting local innovation capacity.

Overall, market trends in India's blockchain space point to aggressive growth fueled by a confluence of factors: strong government advocacy and enthusiastic enterprise adoption. The Indian blockchain market is expected to expand rapidly as it finds use in finance, public services (e.g. land registries, identity management), and extensive supply chains.

However, the development of advanced platforms increasingly relies on specialized skills in emerging technologies such as AI, blockchain, IoT, and product design. In India, the cost of such manpower has been rising steadily, driven by rapid technology adoption and the limited supply of trained professionals in these domains. As enterprises accelerate AI, IoT, and blockchain-led initiatives, this talent gap is expected to persist over the next five to ten years, keeping manpower costs high and reinforcing skilled human capital as a critical input for product

and platform development. While challenges like regulatory uncertainty and skill gaps persist, the trajectory is clearly towards mainstreaming blockchain as a cornerstone of India's digital infrastructure in this decade.

1.13.2. Asia-Pacific (Excluding India) Blockchain Market Overview

Across the broader Asia-Pacific region, blockchain adoption is surging, underpinned by heavy government investment and widespread digital transformation efforts. The Asia-Pacific blockchain technology market is forecasted to be one of the fastest-growing globally, driven by innovative business models, rapid digitalization, and increasing tech accessibility. Government-led initiatives are especially notable. China stands out with a massive nationwide push for enterprise blockchain. The Chinese government considers blockchain a strategic technology and has rolled out ambitious plans, for example, Shanghai aims to fully implement an city-wide blockchain infrastructure by 2025 to streamline economic processes, public services, and even carbon tracking and supply chain finance. This is part of China's broader national blockchain roadmap, which envisions an integrated public-private blockchain infrastructure by 2029, backed by tens of billions in investment. China's approach is "blockchain, not crypto," focusing on permissioned networks that improve efficiency and trust in trade and government transactions.

In Southeast Asia and East Asia, smaller nations are also trendsetters. Singapore has positioned itself as a blockchain innovation hub with supportive regulations and practical projects. A prime example is Singapore's TradeTrust framework, a government-backed initiative using blockchain to digitalize cross-border trade documents and combat the inefficiencies of paper-based trade. By connecting businesses and governments to a public blockchain for document verification, TradeTrust enables instant authenticity checks and title transfers for shipping documents, reducing fraud and delays in international commerce. Singapore's Monetary Authority (MAS) likewise has piloted blockchain in areas like cross-border payments and asset tokenization, reflecting a regional appetite for fintech innovation. South Korea and Japan are not far behind: South Korea's government has pledged significant funding to blockchain startups and is fostering public-private collaboration for use cases from smart logistics to digital identity, while Japanese initiatives explore blockchain in everything from supply chain management to energy trading as part of the country's Society 5.0 vision. Even Australia and others in Oceania are experimenting with blockchain for supply chain traceability (e.g. agricultural exports) and financial services, in line with their advanced digital economies.

These trends show APAC's focus on enterprise and supply-chain blockchain applications. The region is a global manufacturing and trade center, so there's high demand for technologies that improve transparency and trust among trading partners. Blockchain is being leveraged to verify product provenance (combatting counterfeits in electronics, luxury goods, and food exports) and to streamline trade finance. For instance, major ports in Asia joined blockchain-based shipping consortia to enable paperless bills of lading and real-time cargo tracking (one such effort was the IBM/Maersk TradeLens platform, which Asian ports like Singapore and Shenzhen participated in). Likewise, pharmaceutical supply chains in Southeast Asia have begun using blockchain to ensure drug authenticity and safety for consumers. Another indicator of momentum is the capital flowing into the sector: in 2023, Singapore-based blockchain startups reportedly raised over $2 billion in funding (a sharp increase from the previous year), pointing to strong investor confidence in APAC's blockchain future. By 2030, the Asia-Pacific region is expected to see pervasive blockchain integration in trade networks, logistics, and smart cities, as supportive policies and clear business benefits (efficiency, cost savings, and fraud reduction) continue to drive adoption.

1.13.3. Middle East Blockchain Market Overview

The Middle East is riding a wave of blockchain adoption, led by visionary government strategies and a need to enhance efficiency in commerce and public services. The Gulf Cooperation Council (GCC) countries, in particular, view blockchain as a tool to solidify their role as global trade and logistics hubs. Many Middle Eastern economies are strategically located at the crossroads of Europe, Asia, and Africa, which has made supply chain modernization a top priority. Blockchain technology is being embraced to tackle challenges in this domain - improving transparency, speeding up transactions, and adding security in logistics and trade operations. For example, leading regional logistics players have piloted blockchain for real-time shipment tracking and fraud

prevention; logistics companies like Maersk's regional units and Dubai-based Aramex report that blockchain provides unprecedented end-to-end visibility into cargo movements. One study even found that adopting blockchain could cut operational costs for Saudi Arabia's logistics firms by 25% on average, a compelling figure driving interest in the technology.

Government initiatives form the backbone of the Middle East's blockchain surge. The United Arab Emirates is at the forefront: Dubai's government launched the *Dubai Blockchain Strategy* with the bold aim of transforming Dubai into a fully blockchain-powered city by 2030. This strategy seeks to migrate many government transactions and services onto blockchain networks to boost efficiency, transparency, and security. In practice, Dubai has already implemented blockchain in various public sectors, for instance, Dubai's blockchain-based trade portal has drastically cut paperwork for import/export, and the Dubai Land Department uses blockchain to record property transactions. Notably, UAE's DP World, one of the world's largest port operators, built a blockchain platform that reportedly slashed shipping document processing times significantly, while Dubai Customs also witnessed a significant reduction in the time needed for shipment tracking after integrating blockchain solutions. These tangible benefits underscore why the UAE continues to champion blockchain across government and industry. Neighboring Gulf states are following suit: Qatar established a national *Blockchain Platform* via its financial center to encourage blockchain use in finance and supply chain. Qatar's framework supports tokenization of real-world assets under a clear regulatory regime, even allowing 100% foreign ownership for blockchain companies – all part of an effort to attract global players and diversify its digital economy. The platform is geared toward end-to-end supply chain visibility, enabling real-time tracking of goods to build trust among all stakeholders. Saudi Arabia has incorporated blockchain into its Vision 2030 diversification plans; for example, Saudi Customs engaged in pilots to use blockchain for accelerating cross-border trade clearances, and Saudi Aramco joined international blockchain consortia (like Vakt for energy trading) to streamline operations. Bahrain and the UAE were also among the first to issue crypto-asset regulations in the region, creating a friendly environment for blockchain startups in fintech and beyond.

Overall, the Middle East's blockchain market is characterized by strong top-down support and collaborative pilot projects. Governments often provide financial incentives and sandboxes to encourage private-sector adoption. The region's focus is largely on enterprise use cases – trade, logistics, supply chain finance, and smart governance – rather than speculative crypto trading. As investments continue and early successes are scaled up, the Middle East is poised to be a global leader in blockchain-enabled logistics and smart city services by 2030. The convergence of blockchain with other emerging tech (IoT and AI) is also on the horizon in this region, promising even greater supply chain visibility and automation in coming years.

1.13.4. Europe Blockchain Market Overview

Europe's blockchain landscape is being shaped by a mix of enterprise-driven use cases and supportive regulatory frameworks. European industries have been quick to explore blockchain to enhance transparency, security, and sustainability in supply chains. One prominent trend is the use of blockchain for supply chain traceability and consumer trust, especially in sectors with stringent quality and safety standards. For instance, Europe's largest retailer Carrefour has pioneered blockchain-based food traceability to meet consumers' growing demand for information on product origin and organic farming methods. By scanning a QR code, Carrefour customers can instantly access the farm-to-shelf history of products (like free-range chicken or organic milk), an unprecedented level of transparency that strengthens brand trust. Similarly, food and beverage multinationals like Nestlé in Europe are leveraging blockchain to track coffee beans and ingredients across continents, allowing verification of certifications (fair trade, organic) in seconds. These efforts align with European consumers' and regulators' emphasis on food safety, authenticity, and sustainability. They also prepare companies for new EU sustainability regulations, since blockchain can provide a tamper-proof audit trail of a product's environmental and social footprint – an approach the European Commission actively encourages to support the Green Deal goals.

In the logistics and trade domain, Europe has seen high-profile implementations of blockchain to streamline operations. A notable example is the Port of Rotterdam, Europe's largest seaport, which partnered with IBM to create a blockchain-based logistics platform. This system records every container movement and transaction on an immutable ledger, enabling real-time tracking of shipments and automating processes like customs clearance

and payments via smart contracts. The result is faster and more cost-effective cargo handling, with paperwork greatly reduced. Such pilots demonstrate the clear efficiency gains blockchain offers for Europe's complex, cross-border supply chains. Many European shipping and freight companies are now part of blockchain consortia to digitize trade documents (bills of lading, certificates) and share data securely across port authorities, carriers, and customs. Likewise, in manufacturing, automakers and aerospace firms in Europe have experimented with blockchain for tracking parts and ensuring maintenance records integrity, which improves safety compliance across global supply networks.

A defining feature of Europe's blockchain trajectory is the strong role of governments and the EU in shaping a conducive environment. European regulators have generally taken a balanced approach: protecting market integrity and privacy while promoting innovation in blockchain. The European Union established the EU Blockchain Observatory and Forum to facilitate collaboration and knowledge-sharing on blockchain applications, including supply chain management improvements. The EU has also coordinated the European Blockchain Partnership, which is developing a cross-border public-service infrastructure (EBSI) using blockchain for things like diploma certification, business registries, and digital identity verification among member states. These efforts are complemented by the European Blockchain Sandbox (launched in 2023) which allows companies and regulators to pilot blockchain solutions in areas like trade and energy under regulatory guidance. On the policy front, the EU's Markets in Crypto-Assets (MiCA) regulation (enacted 2023) provides legal clarity for crypto and stablecoins, indirectly encouraging traditional financial institutions to explore blockchain-based digital assets under a clear rulebook. Moreover, the European Commission explicitly supports blockchain for climate action and sustainability, funding projects that use blockchain to track carbon emissions and green energy usage across supply chains. This dovetails with Europe's broader push for ESG transparency; for example, blockchain is seen as a tool to implement "digital product passports" that store a product's entire lifecycle information (material sourcing, recycling data, etc.) in a secure, shareable form.

Looking ahead to 2030, Europe is expected to continue its pragmatic and purpose-driven adoption of blockchain. Key drivers include the need for compliance and standardization (meeting strict EU regulations on data, finance, and sustainability), as well as a desire to boost competitiveness through efficiency. By embracing blockchain in a regulated way, European companies aim to reduce fraud (for instance in luxury goods or pharmaceuticals supply chains) and cut administrative costs via automation. The benefits have already been observed – from reducing food recall times from days to seconds in retail, to eliminating paperwork and intermediaries in trade logistics. While challenges such as interoperability and legacy IT integration remain, industry collaborations and EU-wide standards are actively addressing them. In summary, Europe's blockchain market trends toward steady growth and maturation, with blockchain becoming an invisible backbone in areas like supply chain transparency, trade finance, and green finance. By 2030, Europe envisions blockchain and related Web3 technologies as integral to its digital economy, supporting everything from smart supply chains to decentralized energy grids, all under the umbrella of robust governance and trust.

1.14.   Competitive Landscape

Globally, the IT Services & Solutions market is composed of three key segments. First, it includes large-scale IT providers offering a broad range of services such as consulting, systems integration, infrastructure, managed services, and BPO—led by firms like Accenture, IBM, TCS, and Capgemini etc. Second, while not traditional IT service vendors, hyperscalers such as AWS, Microsoft Azure, and Google Cloud play a critical role due to their dominance in cloud infrastructure and growing influence in AI and hybrid-cloud deployments. Finally, a new wave of segment leaders and disruptors is emerging—comprising AI-first consultancies like Xavier AI, Perceptis, and Unity Advisory, along with SaaS and data platform companies like Salesforce, Adobe, Intuit, and Snowflake, which are expanding into consulting-driven cloud solutions.

In summary, the global IT Services & Solutions landscape is shaped by hyperscalers leading cloud infrastructure, Tier-1 system integrators capturing a significant share of IT services revenue, and niche specialists driving competitive pressure in AI, BPM (Business Process Management.), and digital transformation.

1.14.1.   Top Vendors in the IT Services & Solutions Market in US

The U.S. IT Services & Solutions market closely mirrors the global landscape, where leading global system integrators (GSIs) and IT services firms continue to dominate. These players—such as Accenture, TCS, IBM, Capgemini, and Cognizant—offer deep capabilities across consulting, systems integration, infrastructure management, managed services, and business process outsourcing (BPO). In parallel, hyperscalers and cloud solution providers—including AWS, Microsoft Azure, and Google Cloud—though not traditional IT services vendors, play a critical role by enabling enterprise IT through their cloud platforms and increasingly delivering packaged solutions and consulting services. Additionally, specialists and managed service providers (MSPs) remain integral to the market, with a strong focus on government, healthcare, infrastructure, and other verticals where deep domain expertise and regulatory alignment are essential.

1.14.2.   Key Product/Service Categories

The global & US IT services & solutions market is broadly segmented into several core product and service categories, each addressing different enterprise technology needs.

1.   Consulting & Advisory Services
   •   Consulting services help organizations design, align, and execute their IT strategy in line with business goals. Core areas include Guidance on digital operating models, IT roadmaps, and business alignment (IT Strategy & Transformation), Design thinking, innovation labs, and emerging tech exploration (Digital Innovation Advisory), Technology Risk mitigation & regulatory Compliance, Cybersecurity Consulting, Sustainability & Green IT.

2.   Systems Integration Services
   •   This category focuses on enabling interoperability between diverse technologies and systems. Key offerings are Custom Application Development (Building scalable, enterprise-grade apps), Legacy Modernization (Migrating from outdated technologies to modern cloud-native stacks), Enterprise Systems Implementation (Deploying and integrating ERP, CRM, SCM, and HCM platforms like., SAP, Oracle, Salesforce), API & Middleware Integration (Connecting disparate systems through APIs and service buses).

3.   Infrastructure Services
   •   This segment covers the backbone IT architecture and its ongoing management. This includes Data Center Management, Server, Storage & Network Services (Provisioning and managing physical and virtual infrastructure), Virtualization Services (Implementing VMware, Hyper-V, Citrix, etc.), Enterprise Backup & Disaster Recovery).

4.   Managed Services
   •   Outsourcing the day-to-day management responsibilities of IT functions like IT Infrastructure Outsourcing (ITO) (management of servers, desktops, networks), End-User Computing (EUC): (Helpdesk, device management, and desktop virtualization), Managed Security Services (MSS) (Real-

time monitoring, threat detection, and response), Cloud Management Services (Multi-cloud monitoring, cost optimization, performance tuning).

5. Business Process Services (BPO/BPM)
   - Involves outsourcing non-core but essential business processes like Finance & Accounting Outsourcing (FAO), Human Resource Outsourcing (HRO), Customer Support Services, Industry-Specific BPM (Insurance claims processing, healthcare RCM, loan servicing).

6. Application Services
   - This segment ensures the full lifecycle support of enterprise applications. Key areas include Application Development & Maintenance (ADM) (Agile or traditional builds, support, and enhancement), Quality Assurance & Testing, DevOps Services (automated deployments, infrastructure-as-code), Mobile & Web Development (Cross-platform responsive development using modern frameworks).

7. Cloud & Platform Services
   - Cloud-first transformation and platform engineering to enhance agility and scalability. Typical offerings include: Cloud Migration Services (Transitioning workloads from on-prem to public/hybrid clouds), Multi-Cloud & Hybrid Cloud Management, Platform-as-a-Service (PaaS) Enablement, Containerization & Microservices (Kubernetes, Docker, and modern microservice deployments).

8. Data & Analytics Services
   - Data-driven services to support decision-making and innovation. Core areas include Data Engineering & Warehousing (Data lakes, ETL/ELT pipelines, and cloud-native storage), Business Intelligence (BI) (Dashboards, KPIs, and visualization (Power BI, Tableau, Qlik)), Advanced Analytics (Predictive and prescriptive analytics using ML models), Data Governance (Master data management, lineage tracking, privacy and compliance frameworks).

9. Cybersecurity Services
   - Dedicated services to protect digital assets, data, and infrastructure. Includes Threat Intelligence & Monitoring, Identity & Access Management (IAM), Compliance Management (Ensuring adherence to PCI-DSS, ISO 27001, SOC 2, HIPAA, etc.), Security Architecture & Design (Zero trust, secure SDLC, network segmentation).

10. Emerging Technology Services
    - High-growth, innovation-led areas transforming how IT services are delivered. Includes Artificial Intelligence & Machine Learning (AI/ML), IoT, Blockchain, AR/VR & Spatial Computing.
    - These service categories are often bundled into end-to-end digital transformation programs, especially by large system integrators. Growth in 2024–2026 is expected to be strongest in cloud modernization, AI/ML services, cybersecurity, and data platform engineering, according to industry analysts like Gartner and IDC.

1.15. Key Service Providers Profiled

Frost & Sullivan has identified Happiest Minds, Newgen Software and Saksoft as the most relevant peers from amongst different industry players given their similarity in revenue verticals, operating models, and market positioning. The selected peers represent the best comparables as their business mix is closely aligned with Bonbloc across major streams.

Exhibit 72: Key Service Providers Profiled

	End User Industries focused	Geographical Revenue Concentration (Top 2/3)	Products & Services Offered
Bonbloc	1. Food Service and Groceries 2. Public Transportation / Government Transport 3. Healthcare & Pharma 4. Food & Food Safety / Supply Chain Traceability 5. Finance & Banking	Data Not available	**Products**: 1. **DSCSA (**solution for traceability, compliance with the U.S. Drug Supply Chain Security Act.) 2. **FSMA** (Tool for compliance with FSMA (Food Safety Modernization Act). 3. **Edge Data** (IoT / sensor-based edge data product, captures data like temperature, sound, level, moisture etc., & integrates into supply chain / operational decisions) **Digital Transformation Services:** Business Intelligence & Analytics, ERP Services, Big Data Services, IT Infrastructure Support Services, Blockchain Services.
Happiest Minds	1. Industrial, Manufacturing & Energy/Utilities 2. Healthcare & Life Sciences 3. Retail, CPG & Logistics 4. Banking, Financial Services & Insurance (BFSI) 5. Hi-Tech & Media & Entertainment 6. Education Technology (EdTech)	United States (~65%) India (~16%) Europe (~8%)	**Product & Digital Engineering** (Platform development & modernization, Integrated customer & user experience, FPGA, hardware & embedded engineering, Networking & edge computing solutions, Video engineering & content management, Ad-tech engineering & analytics) **Generative AI and digital transformation services** (Strategy & advisory, Architecture & build, Solutions & accelerators) **Infrastructure management & cybersecurity services** (Infrastructure consulting, Hybrid / multi-cloud, Digital workplace & network, ITSM / ITOM tools & platforms, Managed services)
Newgen Software	1. Banking & Financial Services 2. Government/Public Sector 3. Insurance	EMEA (Europe, Middle East & Africa – largest ~32%) India (~31%)	Unified low-code automation platform (NewgenONE) Intelligent process automation (BPM / workflow) & content management (ECM) Omnichannel communication management with AI/ML capabilities

		United States (~21%)	
	4. Healthcare & Life Sciences		
		APAC (excl. India) (~16%)	
Saksoft	1. Fintech / Banking & Financial Services 2. Logistics & Transportation 3. Healthtech / Healthcare 4. Retail & Manufacturing 5. Utilities 6. Hi-tech, Media & Telecom 7. Public Sector / Emerging Verticals (including education, government services)	USA - 42% Asia Pacific - 35% Europe - 23%	**Service offerings & products/accelerators:** 1. Software / Product Engineering 2. Accelerators / Tools - SakPilot: an AI-driven development accelerator to streamline SDLC, reduce manual effort, improve developer productivity. SakVerse: a platform-agnostic test automation solution (e.g. integrating with tools like JIRA, TestRail) to generate/refine test cases etc. 3. Robotic Process Automation (RPA) / Intelligent Automation 4. ServiceNow / IT Service Management Services 5. Other Services (Mobile Application Development, Application Engineering, Quality Assurance & Testing, Data Analytics , Cloud Services, Infrastructure Management, Cybersecurity Services)

Source: Frost & Sullivan Analysis, Secondary Sources, Company websites

1.15.1.   HAPPIEST MINDS

Happiest Minds Technologies is a mid-tier Indian IT services company focused on digital transformation and product engineering. Founded in 2011 by industry veteran Ashok Soota, it brands itself as "Born Digital. Born Agile," leveraging emerging technologies to drive client innovation. The company is headquartered in Bangalore with operations across the US, UK, Canada, Australia, Middle East, and India. Happiest Minds serves a diversified client base of 250+ customers across key verticals including Industrial & Manufacturing, BFSI (banking, financial services & insurance), Healthcare & Life Sciences, Retail, CPG & Logistics, Hi-Tech & Media, and Education. This vertical breadth reflects its strategy of domain-focused solutions, recently reinforced by a new industry-wise organizational structure introduced in early 2024 to deepen sector expertise.

As a "digital first" IT firm, Happiest Minds offers end-to-end services spanning Product & Digital Engineering, Generative AI and Business Services, and Infrastructure Management & Security. In practice, this means the company builds software products and platforms for clients, implements AI-driven solutions, and manages IT infrastructure and cybersecurity. It works with a spectrum of advanced technologies, from artificial intelligence and machine learning to blockchain, Internet of Things (IoT), cloud computing, digital process automation, virtual/augmented reality, and more – to deliver transformative outcomes. A high proportion of company revenue comes from digital services, reflecting its niche in modern technology areas as opposed to legacy IT.

Happiest Minds has been investing in scaling its business both organically and inorganically. In FY2023-24, it undertook strategic acquisitions to bolster domain capabilities, for example, acquiring PureSoftware (in April 2024) to strengthen its offerings in BFSI and healthcare, and Aureus Tech Systems (acquired in May 2024) to enhance cloud engineering expertise. It also bought a smaller India unit of Macmillan to expand in the EdTech space. These acquisitions not only add annual revenues but also open up new geographic markets in Southeast Asia and Africa via the acquired client base.

1.15.2.   NEWGEN SOFTWARE

Newgen Software Technologies is a leading Indian enterprise software product company, best known for its unified digital transformation platform called NewgenONE. Established in 1992 and headquartered in New Delhi, Newgen has over three decades of experience in enabling large organizations (especially banks and government agencies) to automate their complex business processes and manage content efficiently. The company's NewgenONE platform is a comprehensive low-code, workflow and content management suite that integrates capabilities for process automation, contextual content services, and omnichannel customer communication on a single platform. In essence, Newgen's software allows enterprises to rapidly develop and deploy applications for things like account opening, loan processing, service requests, case management, digitization of paper records, and customer correspondence, with minimal coding. These solutions are enhanced with native AI/ML features and are designed to easily integrate with third-party systems. Newgen enjoys a global presence with customers across 70+ countries, and its geographical revenue mix spans India, EMEA (Europe, Middle East & Africa), APAC, and a growing footprint in the Americas. As of the latest fiscal year, EMEA has been Newgen's largest market, followed by India and the US each.

Newgen is a products company (as opposed to pure services). Its flagship NewgenONE platform comprises multiple product modules, notably: Intelligent Process Automation (a business process management engine for modeling and executing workflows), Content Services (ECM) for enterprise content/document management, and Omnichannel Customer Engagement (often termed CCM – customer communication management). These are complemented by a host of supporting components like a low-code application development environment, data analytics tools, and an integration framework to connect with core banking systems, ERP, etc. Newgen markets industry-specific solutions built on this platform, for example, loan origination systems for banks, insurance claims processing, citizen service portals for governments, and so on. The company caters especially to BFSI (banks, insurance companies), which historically has been its dominant vertical. Besides BFSI, other key customer sectors include Government/public sector agencies, Insurance, Healthcare, and Shared Services (cross-industry back-office operations).

Newgen's business model generates revenue from software product licenses, subscription/ SaaS fees, and implementation & support services. Impressively, Newgen has transitioned a large part of its business to annuity-based streams. The company has also consistently invested in R&D, which has resulted in a steady rollout of product enhancements (e.g. a new AI-powered low-code module called NewgenONE GenAI "Marvin" launched in 2023). This commitment to innovation has earned Newgen recognition from leading analysts and such endorsements underscore Newgen's standing as a credible global software provider.

Newgen's recent strategy has been two-fold: deepening its hold in BFSI while diversifying into new verticals and regions. On one hand, demand from banks remains strong (especially for digital lending, trade finance, and content management solutions in India and the Middle East), and Newgen continues to win large banking deals. On the other hand, the company is consciously expanding in insurance (both life and general insurance) and government segments, recognizing that these offer significant growth potential.

Geographically, Newgen has been strengthening its direct presence in the USA (a traditionally under-penetrated market for them) by aligning with global system integrators and launching cloud-based offerings.

Looking ahead, Newgen's strategic priorities include increasing cloud subscription revenues (to build more recurring income), further innovation in its platform (e.g. embedding generative AI features for document processing and customer service), and capturing more Tier-1 global clients.

1.15.3.   SAKSOFT

Saksoft Limited is a niche Indian IT solutions provider specializing in digital transformation and information management for enterprises. Headquartered in Chennai, India, the company has a global footprint with 16 offices across India, the US, Europe, and Asia and a workforce of over 2,000 professionals. Saksoft positions itself as a "trusted digital partner" particularly for mid-sized and emerging enterprises, helping clients modernize their technology landscape and harness data for business value. Over the past two decades (founded 1999), it has

evolved from offering software testing and business intelligence solutions into a broader digital services firm. Saksoft's client engagements span diverse industries with concentration in Banking/Financial Services (FinTech), Logistics & Transportation, Retail/E-commerce, and other "emerging verticals" including healthcare and high-tech startups. This industry-focused approach is reflected in its revenue mix; for instance, BFSI and fintech-related projects now contribute the largest share followed by logistics and digital commerce.

Saksoft provides a comprehensive suite of IT services that cover the end-to-end digital needs of its clients. Its core competencies include application development and modernization, enterprise data management and analytics, intelligent automation, and cloud & infrastructure services. The company prides itself on being "inch wide, mile deep", meaning it focuses on a defined set of technology areas but offers deep expertise in each. Key service offerings include:

Core Services & Technology Practices

1. Software Engineering & Product Development
   - AI-led Intelligent Product Engineering: Strategy, prototype, development, modernization, and sustainability of software products with integrated AI, automation, and CI/CD
   - Accelerators like SakPilot (code automation, performance analytics) and SakVerse (AI-based test generation integrated with tools like JIRA/TestRail) enhance time-to-market and quality

2. Application Development & Maintenance
   - End-to-end ADM services, including BAU, version upgrades, enhancements, legacy migration, and offshore/nearshore delivery centers

3. Cloud & Infrastructure Services
   - Cloud consulting, migration, infrastructure operations on Azure, AWS, and hybrid environments, aligned with business objectives to reduce costs and boost scalability

4. Data, Analytics & Business Intelligence
   - Full-stack data services: Data warehousing, integration, governance, reporting factories and data science factories to drive predictive insights and intelligent automation

5. Intelligent Automation & RPA
   - Robotic Process Automation (RPA) and AI-led intelligent process automation for process optimization in finance, insurance, logistics, and telecom

6. DevSecOps & Quality Assurance
   - DevSecOps as a service: CI/CD pipeline implementation, security testing, toolchain integration, and ongoing team enablement
   - Digital QA: Test automation, performance/security testing to accelerate defect-free software release cycles

7. Enterprise Integration & IT Security
   - Middleware and SOA integration, legacy modernization, ERP/CRM connectivity, API architecture, and comprehensive IT security frameworks

8. CX Transformation & Commerce
   - Customer journey orchestration, AI-driven CX platforms, digital commerce (Solveda suite) for B2B/D2C engagement, personalisation and loyalty

9. Mobile & Omni-Channel Solutions
   - Native and cross-platform mobile app development, enterprise-grade apps crafted for engagement and digital transformation

Notably, Saksoft has been investing in emerging technologies like AI/ML, IoT, and low-code platforms to augment its offerings. For example, in FY2024-25 it launched initiatives to deliver AI-driven solutions (e.g. chatbots, predictive analytics). These efforts contributed to Saksoft's robust growth in recent years.

Saksoft's strategy has centered on both organic growth (expanding service lines, deeper client mining) and acquisitions to fill capability gaps. In the last fiscal year, the company made two notable acquisitions: CEPTES

Software (Sept 2024) and ZeTechno (Jan 2025). CEPTES is a Salesforce solutions specialist, and its acquisition strengthened Saksoft's capabilities in Salesforce-based cloud CRM implementation and data-led customer experience solutions. Similarly, Saksoft's purchase of ZeTechno, a ServiceNow consulting partner, bolsters its offerings in IT Service Management and workflow automation on the ServiceNow platform. These acquisitions align with Saksoft's focus on high-growth areas and provide access to new client segments.

In terms of vertical strategy, Saksoft continues to deepen its presence in its core sectors. The management highlights fintech (digital banking solutions), logistics (supply chain visibility, etc.), hi-tech startups, and retail as key verticals for tailored solutions.

1.15.4. BONbLOC

Bonbloc Technologies Limited ("Bonbloc") is a subsidiary of BonBloc Inc. (U.S.), founded by Mr. Durai Appadurai and Mr. Sourirajan Govindarajan. Established in 2020 in Chennai, it serves as the core operational base for the Indian market. In September 2024, Bonbloc India expanded internationally by forming Bonbloc Technologies USA Inc., a wholly owned subsidiary to manage U.S., with RBI approval.

Bonbloc Technologies Limited is an Artificial Intelligence ("AI")-native enterprise technology company building next-generation AI-powered SaaS solutions and AI-powered Internet of Things ("IoT") products that deliver intelligence, safety, and compliance at a global scale. Bonbloc's platforms are designed with AI at their core, with blockchain, data science, machine learning ("ML"), and IoT integrated as foundational components. Bonbloc's capabilities position the Company strongly to serve both the business-to-business ("B2B") and business-to-government ("B2G") domains, enabling enterprises and government institutions to adopt AI-driven solutions at scale. As a technology-driven enterprise, Bonbloc provides SaaS solutions and digital transformation services that empower businesses to unlock measurable value through advanced digital tools.

Bonbloc's mission is to support large enterprises with modernization and digital transformation through scalable solutions that integrate blockchain, IoT, and AI technologies. The Company's offerings span application development, business intelligence, digital and cloud services, cybersecurity, and regulatory compliance solutions, with a particular focus on the supply chain and food safety sectors.

Bonbloc India believes that its core strength lies in leveraging emerging technologies such as blockchain, data science, artificial intelligence ("AI"), machine learning ("ML") and the Internet of Things ("IoT"), which enable us to connect, collect, analyse and interpret critical data in order to enhance visibility and traceability across operations.

Bonbloc's flagship platform, Onelign, together with its edge-to-cloud product ecosystem, integrates AI, ML, blockchain, and IoT into a unified architecture. This integration enables real-time decision-making, predictive analytics, and automated responses in complex and regulated environments. Bonbloc's mission is to expand the application of AI across the physical and digital value chain, connecting data, devices, and decisions.

Through the Onelign platform, Bonbloc provides solutions that assist customers in addressing industry challenges across supply and service chains. These include establishing secure transaction connectivity across trading partner systems, enhancing traceability across transaction networks, improving visibility, and streamlining operations.

In addition, Bonbloc's Digital Transformation and Modernization Solutions segment focuses on delivering customizable offerings for organizations with complex structures. These solutions integrate emerging technologies into traditional workflows, thereby supporting enterprise-wide digital transformation requirements.

The industry has witnessed the rise of AI-native enterprises that combine AI models, training pipelines, and edge inference engines to form the backbone of both SaaS offerings and hardware-enabled deployments. Bonbloc represents one such player, with a focus on embedding intelligence at every layer of the enterprise stack—connecting applications with devices, and devices with each other—across industries such as food and groceries, Pharmaceuticals, supply chains, agriculture, and civic governance.

Bonbloc's flagship platform, Onelign, illustrates how AI, IoT and blockchain can be operationalized across diverse contexts:

- Smart Public Transportation: Bonbloc has developed AI-driven transit platforms designed to enhance commuter safety and accessibility. These systems include automated stop announcements, real-time security threat alerts, and contextual guidance for nearby hospitals and essential services.
- Operational Integrity and Compliance: Bonbloc's pattern recognition and anomaly detection engines support predictive maintenance, quality control, and compliance monitoring, helping enterprises reduce risks and enhance productivity.
- Digital Trust and Governance: The Company has built AI-SaaS platforms aligned to regulations such as the Drug Supply Chain Security Act (DSCSA) and the Food Safety Modernization Act (FSMA). These include Onelign DSCSA, Onelign FSMA, ESG dashboards, and civic governance modules, all of which automate compliance workflows, deliver predictive insights, and secure data provenance through blockchain-backed audit trails.
- Smart Environment Monitoring: Bonbloc is also developing AI-powered sensing solutions for wet/dry detection and moisture monitoring, with applications in precision agriculture, tea processing, and waste management. These offerings aim to optimise resource utilisation, improve product quality, and reduce inefficiencies.
- Telemetry-Embedded Logistics: In critical sectors such as pharmaceuticals, petrochemicals, and food distribution, Bonbloc is piloting logistics systems that integrate embedded telemetry with AI. These solutions enable precise planning and execution of complex fleet operations, enhancing traceability, safety, and reliability in supply chain execution.

What differentiates Bonbloc's platforms is the strong emphasis on regulatory alignment and interoperability. Onelign modules are built to conform to global standards such as GS1.org and the World Wide Web Consortium (W3C). The integration of Hyperledger Fabric, an open-source blockchain framework, provides immutable audit trails and verifiable data provenance for regulatory reporting. Combined with IoT triggers for compliance events and AI tools for risk detection, Bonbloc positions its solutions as trusted, compliant, and scalable platforms for enterprises and governments in highly regulated industries.

BonBloc is building one of India's largest AI Centers of Excellence dedicated to enterprise supply and service chain transformation, delivering next-gen GenAI and Agentic AI solutions. The company's vision is to lead the "AI-as-a-Service" revolution globally from India.

The company is strategically positioned at the intersection of AI, enterprise software, and digital transformation, targeting the billion-dollar markets of both GenAI and Agentic AI globally.

AI-as-a-Service (ONELIGN Platform)

The company's Onelign suite of AI-SaaS solutions, including Onelign DSCSA and Onelign FSMA, is purpose-built for regulated industries such as pharmaceuticals, food, and grocery retail. Leveraging blockchain, AI, and IoT, these platforms provide real-time visibility, event-triggered monitoring, and seamless compliance with global standards, delivering holistic product-and-service solutions for their customers. Onelign suite of SaaS offerings is purpose-built to address industry-specific challenges, domain-specific solutions offerings including secure data exchange, regulatory compliance monitoring, and supply & service chain management, across sectors such as pharmaceuticals, food & agriculture, automotive, logistics, manufacturing, education, and smart public governance. In addition, the company supports enterprises with digital transformation and modernization solutions, integrating their proprietary platforms with both legacy and modern enterprise systems, cloud infrastructure, and custom applications.

ONELIGN, the company's flagship "AI Software-as-a-Service" platform, brings the power of Generative AI to mission-critical enterprise functions ranging from customer experience and sales enablement to compliance, finance, and IT operations.

The company's AI solutions integrate seamlessly with cloud ERP ecosystems, enabling a dual-mode delivery model: front-end data insights and back-end managed data services.

Onelign Traceability and Onelign Food Compliance are purpose-built modules designed for highly regulated sectors such as pharmaceuticals, food, and agriculture. The suite integrates IoT hardware with food safety dashboards and cold chain monitoring systems, ensuring compliance with FDA, DSCSA, FSMA, and ESG norms. Leveraging blockchain for immutable audit logs and secure data assurance, these solutions enable package-level traceability, sensor-based temperature and location tracking, and event-triggered compliance alerts—delivering end-to-end visibility, regulatory adherence, and supply chain integrity.

Strategic Advantage & Scalability

With deep roots in both legacy enterprise systems and modern ERP ecosystems, BonBloc brings a rare dual advantage: digital transformation insight and AI-native innovation.

The company's ability to combine AI with domain-rich automation gives them a competitive edge across high-growth sectors such as manufacturing, logistics, retail, insurance, and energy.

The company is actively aligned with the India AI mission, and their AI roadmap includes commercial and public-sector deployments—supporting both export revenue generation and national digital priorities.

As of August 31, 2025, the company is supported by 315 employees across 3 locations in India and 1 location overseas, enabling them to deliver global solutions with local expertise. The company's team comprises highly skilled professionals. This strong R&D capability, combined with their multi-location presence, reflects the company's focus on continuous innovation, product excellence, and the ability to consistently deliver differentiated, technology-driven solutions tailored to diverse customer needs.

The company's USA subsidiary provides significant strategic advantages by enabling them to customize solutions for local regulatory environments, capture cross-border opportunities, and efficiently execute enterprise technology projects. This on-ground presence enhances their agility in addressing regional requirements such as contract structuring, data residency, localization, and statutory compliance, while reinforcing their broader global expansion strategy and operational resilience.

2D Barcode Market Entry (iSCAN2D)

Bonbloc's entry into the high growth 2D barcode reader market with iSCAN2D positions them in the compliance, traceability, and data capture value chain.

iSCAN2D is uniquely built for software-first, hardware-light deployment—enabling secure traceability, compliance, and inventory visibility across logistics, healthcare, manufacturing, and public-sector G2C use cases.

With regulatory drivers like Sunrise 2027, and deep integration with ONELIGN, iSCAN2D allows Bonbloc a scalable entry point into supply chain intelligence and smart data sharing.

Live Tracking & AdTech in Public Transport

BonBloc's smart public transport platform combines real-time vehicle tracking with an integrated advertising engine—monetizing mobility data and improving commuter experience.

iBOTZ is an unique solution designed for public transport, public spaces and high-traffic environments, combining GPS-enabled announcements with AI-driven analytics. It delivers real-time, location-based notifications to improve communication efficiency during events, transit operations, and emergencies. With AI-powered footfall tracking, mass imaging and counting, iBOTZ enables users to monitor density, anticipate bottlenecks, and ensure safety. By integrating communication and analytics, iBOTZ positions Bonbloc as a leader in smart, technology-driven crowd and public transport and space management.

This positions the company in the growing public transport digitization market, with a differentiated business model driven by both civic value and commercial monetization.

Sustainable Revenue Levers

Bonbloc's platform-first approach enables recurring revenue streams across AI-SaaS, AI agents, barcode platforms, and device management tools.

ONELIGN, allowing them to deliver scalable, cloud-native solutions with minimal reliance on external platforms.

The company's focus on efficient models, AI agents, and edge-to-cloud data orchestration uniquely positions them for global expansion, asset-light growth, and strong margin realization.

The integration of blockchain technology enables immutable audit trails and verifiable data provenance, creating a trusted foundation for regulatory reporting. IoT provides real-time compliance event triggers, while AI and ML support proactive identification of risks and gaps across operations. The company's adherence to ISO 9001:2015, ISO 27001:2022, ISO 20000-1:2018 and CMMi-5 certifications, together with their global delivery footprint, underscores their commitment to building reliable, compliance-driven solutions. Notably, Bonbloc's CMMI-5 certification reflects the highest level of process maturity and capability.

BonBloc is a next-generation enterprise AI native company, delivering scalable solutions through its flagship ONELIGN platform. With deep domain expertise in ERP, supply chain, compliance, and enterprise automation, the company combines cutting-edge innovation with practical execution. Bonbloc's investments in AI, IOT and blockchain, and smart public platforms position them as a disruptor in multiple high-growth global markets with a vision to be among the top providers of AI solutions worldwide.

The company is committed to operational excellence through three key priorities. First, they are enhancing the modularity and automation of their platforms to enable faster deployments and lower implementation costs. Second, they are optimising their global delivery mix by leveraging their offshore centres in India, helping them reduce costs, improve responsiveness. Third, they are introducing shared delivery standards across their AI SaaS platforms and Digital Transformation services to ensure consistency, scalability, and cost efficiency while meeting the diverse requirements of their customers.

The company has demonstrated a consistent track record of strong financial performance over the last three fiscals. Their revenue from operations grew from ₹198.12 million in Fiscal 2023 to ₹1033.72 million in Fiscal 2025, representing a CAGR of 128.42%. During the same period, their EBITDA margin improved from 16.51% to 43.59% and PAT margin from 10.63% to 32.39%, reflecting their ability to capitalise on market opportunities, strengthen profitability, and scale across sectors.

Financial Benchmarking (in INR Mn)

Key Performance Indicators	Metric	Bonbloc Technologies Ltd			Happiest Minds Technologies Ltd			Newgen Software Technologies Ltd			Saksoft Ltd		
		FY 2025	FY 2024	FY 2023	FY 2025	FY 2024	FY 2023	FY 2025	FY 2024	FY 2023	FY 2025	FY 2024	FY 2023
Revenue from Operations	₹ In Mn	1,033.72	372.32	198.12	20,608.40	16,246.60	14,292.90	14,868.79	12,438.29	9,739.79	8,830.09	7,616.25	6,656.04
EBITDA	₹ In Mn	450.55	79.74	32.71	3,544.20	3,358.50	3,588.60	3,762.05	2,883.10	2,122.17	1,462.57	1,366.86	1,081.53
EBITDA Margin	%	43.59	21.42	16.51	17.20	20.67	25.11	25.30	23.18	21.79	16.56	17.95	16.25
EBIT Margin	%	42.36%	18.13%	13.53%	12.89%	17.08%	22.18%	23.08%	20.93%	19.26%	15.13%	16.38%	14.75%
PAT	₹ In Mn	334.87	54.17	21.07	1,846.60	2,483.90	2,309.90	3,152.42	2,516.05	1,770.12	1,087.98	961.74	819.77
PAT Margin	%	32.31	14.53	10.63	8.54	14.53	15.93	20.33	19.48	17.56	12.09	12.51	12.14
Revenue CAGR	%	128.42			20.08			23.56			15.18		
EBITDA CAGR	%	271.15			-0.62			33.14			16.29		
PAT CAGR	%	298.68			-10.59			33.45			15.20		
Debt to Equity Ratio	Times	0.01	-	-	0.74	0.30	0.56	-	0.00	0.00	0.09	0.02	-
ROE	%	68.17	63.28	72.51	11.73	16.78	27.54	20.85	20.63	18.09	17.57	19.03	20.26
ROCE	%	118.82	196.79	106.17	15.84	47.36	51.58	31.29	30.79	24.22	28.07	38.84	37.62
Employee Count CAGR	%	15.30%			4.79%			12.54%			33.18%		
Revenue per employee	₹ In Mn	4.71	1.94	1.39	4.15	3.43	3.43	3.75	3.51	3.29	5.55	6.71	5.99

Key Performance Indicators	Metric	Bonbloc Technologies Ltd			Happiest Minds Technologies Ltd			Newgen Software Technologies Ltd			Saksoft Ltd		
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Source: Annual Reports, Other secondary sources
Financials in INR million.
Data for all the respective companies is for the respective financial years ending March 2023, 2024 and 2025; Fiscal year considered for these companies is April-March

The table represents consolidated financials for the respective companies including all lines of businesses.

1) *'Revenue from operations' means revenue from operating activities.*

2) *'EBITDA' means Earnings before interest, taxes, depreciation and amortization expense, arrived at by obtaining the profit before tax/ (loss) for the year and adding back finance costs, depreciation and amortization and impairment expense and reducing other income and exceptional items.*

3) 'EBITDA Margin' is calculated as EBITDA as a percentage of revenue from operations.

4) 'EBIT Margin' is calculated as EBIT as a percentage of revenue from operations, where EBIT means EBITDA minus depreciation and amortization expense.

5) 'PAT' represents total net profit after tax for the fiscal.

6) 'PAT Margin' is calculated as PAT divided by total income.

7) 'CAGR' refers to Compounded Annual Growth Rate.

8) 'Debt to Equity Ratio' is calculated as total debt divided by total equity. Total debt is the sum of total current & non-current borrowings; total equity means Net worth.

9) 'ROE' is calculated as PAT divided by Net worth.

10) 'ROCE' is calculated as EBIT divided by capital employed where (i) EBIT means EBITDA minus depreciation and amortization expense and (ii) Capital employed means Net worth + total current & non-current borrowings– cash and cash equivalents and bank balance appearing under current assets.

11) 'Revenue per Employee' means Revenue from Operations for the fiscal divided by the average count of permanent employees.

Based on the comparative benchmarking above:

- Bonbloc delivered the fastest top-line expansion in the considered peer set with Revenue CAGR FY23–FY25 of ~128%, materially outpacing mid-cap IT peers (≈15–24% CAGRs). This validates strong product–market fit and an effective GTM playbook

- Bonbloc witnessed profitable growth. EBITDA scaled ~13.6x with margin expansion from 16.5% to 43.6%; PAT rose ~16x with PAT margin up from 10.6% to 32.3%.

- Bonbloc displayed Best-in-class capital efficiency and sustained, very high returns: ROE ~68% and ROCE ~119% in FY25. These ratios underscore an asset-light, platform-led model (Onelign) with disciplined deployment of growth capital.

- Bonbloc also displayed balance sheet strength; growth funded from operations. Near zero leverage (D/E ≈ 0.01 in FY25; nil in FY23–FY24) provides resilience and optionality for R&D, sales capacity, and selective M&A without balance-sheet risk.

- Bonbloc witnessed simultaneous growth in revenue, EBITDA, and PAT with expanding margins, indicating low dependence on one-off items and healthy operating cash generation potential as scale builds.

- Bonbloc's faster growth and superior unit economics position it as a specialist, productized player

1.16. Bonbloc Product Portfolio and Industry Outlook

Bonbloc Technologies offers a suite of AI SaaS products leveraging blockchain, IoT, and AI to modernize industry-specific operations. Each product addresses critical needs in its target sector from pharmaceutical traceability to smart city administration delivering transparency, security, and efficiency. Below is an analytical overview of each company's products, its value proposition, key use cases, and the market context driving demand.

Current Products

Onelign Traceability (Target Industry Vertical: Pharmaceuticals)

Value Proposition: Onelign Traceability is a blockchain-based platform enabling end-to-end tracking of pharmaceuticals, designed to ensure compliance with stringent regulations like the U.S. Drug Supply Chain Security Act (DSCSA). By assigning unique identifiers to drug packages and recording transactions on an immutable ledger, it helps pharmaceutical manufacturers, distributors, and dispensers authenticate products and prevent counterfeits. The platform provides unit-level serialization, secure data exchange, and rapid recall capability, ultimately protecting patient safety and supply chain integrity.

Use Cases: Onelign Traceability enables –

- Regulatory compliance (fulfilling DSCSA's mandate for electronic traceability)
- Anti-counterfeiting (flagging illegitimate or diverted drugs)
- Recall management (quickly isolating affected lots)

For example, all supply chain partners, manufacturers, wholesalers, 3PLs, pharmacies can verify a drug's provenance in real time and be alerted to any anomalies. This is crucial given the rise of counterfeit drugs and global serialization mandates (e.g. EU FMD, emerging markets). The system's blockchain backbone builds trust by ensuring data integrity among trading partners.

Industry Outlook: The pharmaceutical sector's growth and regulations are major demand drivers. The global pharmaceutical industry is valued at more than USD 1.7 trillion in 2024, and projected to grow at a CAGR of 6.3% until 2030, expanding steadily amid rising drug demand and innovation. In parallel, the pharma traceability market is booming as serialization requirements tighten worldwide. In 2024, DSCSA's final phase took effect in the U.S., and similar frameworks (EU's FMD, traceability laws in Asia, Africa, etc.) are being enforced. This regulatory push coupled with the need to curb counterfeit drugs is driving pharma companies to invest in traceability solutions like Onelign. By enabling compliance and supply chain visibility, Onelign Traceability is well-positioned to capitalize on the pharma industry's growth and the increasing emphasis on drug safety and provenance.

Onelign Food Compliance (Target Industry Vertical: Agri & Cold Chain)

Value Proposition: Onelign Food Compliance (powered by Onelign FSMA) offers end-to-end traceability for food and agriculture supply chains, ensuring compliance with food safety regulations such as the FDA's FSMA Section 204. The platform records Key Data Elements (KDEs) and Critical Tracking Events (CTEs) from farm to fork, leveraging blockchain to create an immutable audit trail. By seamlessly tracking food products through processing, cold storage, and distribution, Onelign enables rapid responses to contamination or recalls and strengthens transparency in the agri-food cold chain. Companies can instantly pinpoint a food item's origin and journey, critical for managing outbreaks or quality issues. The solution thus helps growers, processors, distributors, and retailers maintain compliance, reduce waste, and protect consumers.

Use Cases: Key use cases include -

- Traceability of high-risk foods (e.g. produce, dairy, meat) for quicker recall execution
- Cold chain monitoring (capturing temperature/humidity via IoT sensors to ensure perishable goods remain within safe conditions)

- Supply chain visibility for agricultural products

For instance, a produce distributor can trace a batch of lettuce back to the exact farm and field, and if a foodborne illness emerges, isolate affected lots within seconds. Onelign's blockchain ledger and real-time data logging enable proactive recall management, a vital capability given that swift action can reduce recall costs by up to *90%* by precisely targeting only contaminated products. Additionally, the platform's interoperable design goes beyond the traditional "one step up, one step down" tracing; it allows full forward-and-backward tracing across multiple hops. This is particularly valuable in complex agricultural supply networks and helps meet new regulatory expectations for comprehensive traceability (e.g. the EU Farm-to-Fork strategy and global food import/export rules).

Industry Outlook: The agriculture and food industry is under mounting pressure to improve traceability and safety, which boosts demand for solutions like Onelign. The global food traceability market is forecast to grow from about $22 billion in 2024 to $35.9 billion by 2030 (Growing at a CAGR of around 8.5%). Driving this growth are stricter regulations and consumer expectations for transparency. Separately, the cold chain logistics market, key to agricultural and dairy distribution, is expanding rapidly: from roughly $335 billion in 2024 to an estimated $755 billion by 2030 at ~14.5% CAGR. This reflects rising global trade in perishable foods and vaccines, which in turn necessitates advanced cold chain compliance tools. As the food & agri sectors embrace digital traceability (and the FDA's new traceability rule takes effect), growth in these industries will directly translate to greater demand for Onelign Food Compliance. Companies that deploy such solutions stand to not only meet compliance but also reduce spoilage and improve efficiency, gaining a competitive edge in a food industry increasingly focused on safety and accountability.

Status BOT

Value Proposition: Status BOT is Bonbloc's AI-driven status tracking and notification solution that provides real-time supply chain updates through a chat-based interface. This product acts as an intelligent logistics assistant, automatically pulling data from various sources (ERP systems, IoT trackers, courier APIs, blockchain records) to keep stakeholders informed about orders and shipments. By offering transparent, predictive, and automated delivery updates via a conversational interface, Status BOT enhances customer experience and reduces the manual effort of status inquiries. For example, a retailer or end-customer can simply ask the bot, "Where is my order?" and receive an instant, trustworthy update on location, ETA, or any delays, all secured by blockchain for data integrity. The tool can also proactively alert users of anomalies (e.g. a shipment delay due to weather) and suggest interventions, thereby mitigating risks in transit.

Use Cases: Status BOT's primary use cases lie in

- e-Commerce and retail logistics (providing consumers real-time parcel tracking and notifications)
- Freight and 3PL operations (internal teams get instant alerts if a shipment deviates from schedule or conditions)
- Last-mile delivery management (optimizing routes by analysing status data)

For retailers, this kind of automated status visibility reduces "Where is my order?" calls and improves satisfaction. In complex supply chains, the bot can integrate with inventory systems to update production or sales teams when critical components are in transit or delayed. The predictive aspect means it not only tracks current status but leverages AI to forecast potential delays (e.g. port congestion) and notify users in advance. By doing so, Status BOT helps enterprises shift from reactive tracking to proactive logistics management, intervening before issues escalate.

Industry Outlook: The rise of e-commerce and high consumer expectations for fast, transparent delivery underpin the need for status automation. Global B2C e-commerce sales are were valued at US$6.5 trillion in 2024, projected to increase at a CAGR of 12% until 2030, and this growth comes with a surge in parcel volumes and demand for shipment visibility. The last-mile delivery segment alone, crucial for online retail, is also expected to have a similar CAGR. Such scale and growth make manual tracking untenable; businesses are turning to AI chatbots and automated tracking systems to handle the load. Moreover, the broader track-and-trace technology market (across all sectors) is also expected to expand significantly, driven by omnichannel commerce and the need

for real-time updates. In this context, Status BOT addresses a critical gap by fusing blockchain-secured data with user-friendly AI interaction. As companies race to differentiate on delivery experience, and as supply chains become more complex, the growth of e-commerce and logistics industries directly drives demand for Status BOT's automated status tracking capabilities.

Products under Development

Emergency Management

Value Proposition: Bonbloc's Emergency Management solution is an integrated digital platform for disaster response and public safety coordination. By combining IoT sensor inputs, real-time data feeds, and blockchain-secured incident logs, this product helps governments and organizations prepare for and manage emergencies more effectively. Key features likely include centralized command dashboards, automated alerts (for events like equipment failures or natural disaster warnings), secure information sharing among agencies, and audit trails of actions taken. The platform improves situational awareness, for example, by pulling weather data, surveillance camera feeds, and 911 call data into one view, and ensures that critical data (evacuation orders, resource deployments, etc.) is tamper-proof and easily accessible to authorized responders. Ultimately, the Emergency Management module aims to minimize response times and human error when crises strike, whether it's a natural disaster, industrial accident, or security incident.

Use Cases: Primary use cases are found in the public sector and large enterprises: city and regional emergency management agencies can use the system for disaster planning, live incident management, and inter-agency communication. For instance, during a flood or wildfire, the platform could automatically reconcile incoming sensor data (river levels, fire hotspots) with emergency plans, alerting officials to areas at highest risk and recommending resource allocation. Another use case is in public transit safety, recalling Bonbloc's partnership with an Indian state to deploy "Spot Bus" IoT devices on buses for surveillance and emergency assistance. Those devices, feeding into an emergency management system, enable real-time monitoring of transit vehicles and rapid coordination of response if an incident occurs (passenger safety alarms, route deviations, etc.). Corporations with large campuses or industrial sites might also use the solution for business continuity and incident management (e.g. automatically notifying all employees during a facility emergency and logging their safety status). The common thread is real-time, data-driven decision support in emergencies, replacing siloed manual processes with a unified, secure system.

Industry Outlook: Globally, the need for advanced emergency management is growing amid climate change, urbanization, and new security threats. The incident and emergency management market is sizeable, valued around US$140 billion in 2024, projected to grow at a 6.2% CAGR until 2030, and encompasses solutions for disaster preparedness, command & control systems, early warning, and recovery management. Governments in North America, Europe, and APAC are investing heavily in modernizing their emergency response infrastructure, integrating digital technologies to replace paper-based or fragmented systems. In the U.S., for example, federal funding via FEMA and DHS drives adoption of incident management platforms with capabilities similar to Bonbloc's offering. Additionally, IoT and AI are increasingly applied to public safety (from smart siren systems to AI-based risk prediction for disasters), creating a convergence that Bonbloc's solution taps into. As disasters become more frequent and complex, and as regulatory scrutiny of emergency preparedness increases (for industries like oil & gas, utilities, transport), organizations are expected to invest more in robust emergency management solutions. The steady ~6% annual growth of this sector underscores a sustained demand. Bonbloc's blend of IoT data integration and blockchain accountability directly addresses trends in this market, namely the push for real-time coordination, data transparency, and resilient response systems in both the public and private sectors.

Property Registration

Value Proposition: Property Registration by Bonbloc is a blockchain-enabled solution aimed at modernizing how land titles and property records are managed. It provides a secure, single source of truth for property ownership by recording title registries, transfers, and liens on a tamper-evident distributed ledger. The value proposition lies

in bringing transparency, speed, and trust to an area traditionally plagued by paper records, fraud, and inefficiency. With Bonbloc's platform, government land registries can move to digital deeds that stakeholders (buyers, sellers, banks, notaries) can verify instantly, and any change in ownership is immutably logged with timestamps and cryptographic security. This prevents common issues like title duplication or disputes over ownership. It also streamlines property transactions, what once required weeks of manual paperwork and verification can potentially be done in minutes on a trusted digital registry. By ensuring authenticity of records, the solution supports initiatives in affordable housing and city administration that require clear title management and reduces the risk of fraudulent property sales.

Use Cases: The primary use case is with government land registry offices adopting the platform to replace or augment their current systems. For example, a municipality could pilot blockchain-based property registration for a new housing development, issuing digital title deeds to homeowners. This ensures each property's history (from initial registration to any transfers or encumbrances) is traceable and cannot be altered retroactively, significantly cutting down on title verification time for future sales or mortgages. Another use case is facilitating cross-agency data sharing, e.g. linking property records with tax authorities or urban planning departments, since a blockchain record can be easily queried and is permissioned for relevant parties. In countries battling land corruption or where a significant portion of land is unregistered, this solution can formalize property rights and reduce disputes, thereby unlocking economic value. It's also relevant to real estate finance: banks can trust the integrity of a digital title when approving loans, knowing the ledger shows any existing liens. Overall, the solution is about creating digitized trust in real estate transactions.

Industry Outlook: Real estate is one of the world's largest assets, and its digital transformation is accelerating. The property technology (PropTech) market, which includes digital transaction platforms and smart property management, is expected to soar from about $37 billion in 2024 to over $82.5 billion by 2030 (roughly 14.3% CAGR). Within PropTech, blockchain for real estate is emerging as a game-changer: industry reports foresee tokenized real estate and blockchain-based registries becoming mainstream, with one estimate suggesting up to 15% of global real estate assets could be tokenized by 2030. On the public sector side, numerous countries (Sweden, Georgia, India, etc.) have run pilot programs for blockchain land registries, indicating government interest in this technology to improve public services. In fact, Bonbloc itself highlighted affordable housing and city administration as promising use cases for its Hyperledger-based solutions, showing alignment with smart city initiatives. Growth in urban development and smart governance is a positive indicator: the drive to make cities "smarter" includes digitizing citizen services like property registration. By offering a secure, efficient alternative to legacy land record systems, Bonbloc's Property Registration solution is poised to benefit from these trends, helping governments and emerging economies reduce fraud, unlock land value, and meet the rising demand for digital public services.

iBOTZ

Value Proposition: iBOTZ is an intelligent automation platform from Bonbloc, likely combining AI and robotic process automation (RPA) to streamline repetitive business tasks. The product's name suggests "intelligent bots," and accordingly iBOTZ deploys software bots that can handle high-volume, rule-based operations from data entry and validation to document processing and integration between systems with minimal human intervention. Bonbloc's twist is to infuse these bots with AI and possibly IoT connectivity, enabling them to deal with unstructured data and real-world sensor inputs. The value proposition centers on cost reduction, accuracy, and speed. By automating routine workflows (in finance, supply chain, HR, etc.), iBOTZ reduces manual errors and frees up employees for higher-value work. It also leverages blockchain where auditability is needed, ensuring bot actions are transparently logged and verifiable. In essence, iBOTZ helps enterprises achieve "hyperautomation," where multiple tools (AI, RPA, analytics) converge to transform end-to-end processes for greater efficiency.

Use Cases: iBOTZ can be applied across industries wherever repetitive processes exist. For instance, in supply chain operations, an iBOTZ agent might automatically reconcile purchase orders with invoices and shipping receipts, cross-checking data and flagging discrepancies for review. (This ties into Bonbloc's trade reconciliation use case, but here done autonomously by bots.) In finance (BFSI), iBOTZ bots could handle loan document verification or compliance checks, parsing documents with AI and executing transactions on approval. In customer

service, an iBOTZ chatbot might serve as a first-line support agent that interacts with customers and even initiates backend processes to resolve requests. Manufacturing firms might use iBOTZ to link IoT sensor events to automated actions, e.g. if a machine sensor detects a parameter out of range, an iBOTZ routine creates a maintenance ticket and orders a replacement part without human input. The key theme is automating the mundane: wherever a procedure is well-defined but currently manual, iBOTZ can introduce speed and consistency. These bots, enhanced with natural language processing and machine learning, can also handle exceptions better than traditional RPA, making them suitable for more complex tasks over time.

Industry Outlook: The market for intelligent automation is experiencing explosive growth as organizations seek to digitize workflows. The global RPA market alone is projected to climb from about $6 billion in 2024 to over $30 billion by 2030 – a ~30% CAGR, reflecting how rapidly enterprises are adopting automation at scale. Drivers include the pursuit of cost efficiency, labor shortages in certain job functions, and the push for error-free processing. Notably, 3.6% of manual invoices contain errors, leading to financial losses and rework; this type of statistic is prompting companies to invest in smart bots that can eliminate such mistakes. The broader hyperautomation trend (integrating AI into automation) is also robust, the combined market for AI-driven process automation is often estimated in the hundreds of billions of dollars by mid-decade. By infusing AI into bots, iBOTZ addresses the demand for automation that can handle unstructured data (emails, images, sensor readings) rather than just standard forms. Sectors like finance, manufacturing, and retail are all scaling up use of AI bots: for example, the banking industry was the largest adopter of RPA by revenue in 2024. This cross-industry appeal means growth in virtually any sector (finance, healthcare, e-commerce, etc.) contributes to automation adoption. In summary, as businesses continue to digitize operations and seek out productivity gains, the rapid growth of the automation market directly fuels demand for iBOTZ, positioning it as a key tool for organizations aiming to stay efficient and competitive in the digital era.

Recall Management

Value Proposition: Bonbloc's Recall Management solution is a specialized platform to handle product recalls and withdrawals efficiently across the supply chain. It provides companies with the ability to rapidly identify affected product lots, notify all necessary stakeholders (suppliers, distributors, regulators, customers), and execute recalls in a controlled, traceable manner. Powered by the granular traceability data from Bonbloc's Onelign systems (and likely integrated with blockchain for data integrity), this module ensures that when a safety issue arises, the response is swift and well-documented. The value proposition lies in minimizing the scope and cost of recalls by precisely targeting only the impacted items and proving compliance. All actions during the recall from the decision to recall, to notifications sent, to products returned or destroyed are logged on an immutable ledger, creating an audit trail for regulators. This not only reduces legal risk and penalties but also protects brand reputation by showing consumers that the company can react responsibly and transparently. In short, Bonbloc's Recall Management turns a traditionally chaotic, ad-hoc process into a streamlined, data-driven workflow.

Use Cases: The solution is vital in food & beverage, pharmaceuticals, automotive, and consumer goods industries where recalls are unfortunately common and costly. For example, a food company using the system could, upon detecting contamination in an ingredient, trace exactly which batches of finished products used that ingredient and initiate a recall for only those batches (rather than a blanket recall). The module would automate communication: sending alerts to distribution centers and retailers to pull items from shelves, contacting regulators like the FDA, and even reaching out to end-consumers if needed (via email or SMS notifications tied to lot numbers). In pharma, if a drug is found subpotent, the platform helps comply with mandates to notify pharmacies and patients quickly. For automakers, the system can manage the recall of a faulty component by VIN or production run, coordinating with dealers worldwide. Across these cases, a key use case feature is real-time visibility into recall execution, companies can monitor recall progress (percentage of product recovered, responses from each partner) on a dashboard. Another use case is post-mortem analysis: because all recall data is captured, firms can analyze the root cause and response timeline to improve future safety processes. Essentially, Recall Management by Bonbloc serves as an end-to-end recall "command center" that reduces the manual burden on compliance teams and ensures no critical step is missed.

Industry Outlook: Product recalls have enormous financial and safety implications, and industries are investing in tools to manage them better. According to market research, the global automated recall platform market is expected to grow from about US$2.2 billion in 2024 to $3.9 billion by 2030 (around 10% CAGR). This growth reflects the convergence of stricter regulatory oversight and the increasing complexity of global supply chains. Governments are imposing hefty fines and even criminal penalties for slow or ineffective recalls, pressuring companies to improve their capabilities. For instance, U.S. regulations (FDA for food/pharma, NHTSA for autos) demand quicker recall notification and tracking than ever before. The cost of failure is high - beyond fines, a mishandled recall can cost tens of millions in direct costs and far more in lost consumer trust. It's noted that implementing traceability and recall technology can cut recall costs by up to 90% by enabling targeted removals, a compelling ROI for companies. Furthermore, annual recall rates in sectors like automotive and food have been rising, partly due to better detection and global distribution (e.g. a single contaminated ingredient can affect dozens of brands). This trend drives interest in robust recall management systems. As the market outlook shows double-digit growth, Bonbloc's Recall Management is set to benefit by offering what companies need most: a way to limit the impact of recalls through speed and precision. By integrating recall execution with traceability data, it aligns perfectly with industry moves toward end-to-end safety and quality control, making it a timely solution in an era of "zero tolerance" for unsafe products.

Edge Data Management (Agriculture, Dairy, Fluid Monitoring)

Value Proposition: Edge Data Management is Bonbloc's IoT-driven platform for capturing and leveraging field data at the "edge" of operations, particularly in sectors like agriculture, dairy, and fluid management. It enables organizations to collect real-time sensor data (e.g. temperature, humidity, soil moisture, tank levels, vibration, pH) from remote environments and seamlessly integrate these data streams into decision-making processes. The platform likely includes rugged IoT devices, connectivity, and a cloud interface where data is logged on blockchain for authenticity and can be analyzed or queried. By bringing visibility to conditions that were previously hard to monitor continuously, Edge Data Management helps customers improve quality control, reduce waste, and optimize resource use. For example, in a dairy cold chain, sensors can monitor milk temperature throughout transport and storage; if any reading goes out of safe range, alerts are triggered to prevent spoilage. In crop farming, soil moisture sensors connected via the platform allow precise irrigation control, saving water and improving yields. The edge computing aspect means some analytics or threshold triggers can happen on-site (for instant response), with secure summaries recorded to the ledger for auditing and trend analysis. Ultimately, this solution's value is in bridging physical operations with digital intelligence ensuring that critical on-ground data is not siloed but rather trusted, aggregated, and actionable in real time across the enterprise.

Use Cases: In agriculture, farmers and agribusinesses use the platform for precision farming e.g. deploying IoT sensors across fields to track microclimate and soil conditions and then using that data (combined with AI) to guide irrigation and fertilization exactly when and where needed. For instance, Edge Data Management can feed a dashboard that shows a heat map of soil moisture; if one zone is dry, the system could automatically activate drip irrigation there. In the dairy industry, a use case is monitoring milk tanker conditions: temperature and hygiene metrics from farm pickup to processing plant are logged, ensuring cold chain integrity (and compliance with food safety standards). If a refrigeration unit fails, the system would alert managers to intervene before the milk batch is ruined. The fluid monitoring use case extends to any scenario of tracking levels or quality of liquids – for example, monitoring water levels in remote wells or tanks for water utilities, fuel levels in industrial tanks, or even fluid flow in manufacturing processes. An oil & gas company could use it to monitor pipeline pressure or detect leaks early through sensor anomalies, with blockchain logs providing an immutable record of readings over time. Cross-cutting all these is the ability to integrate the edge data with broader supply chain or maintenance systems: Edge Data Management ensures that insights gleaned on the ground (or in transit) promptly inform inventory systems, quality control workflows, or maintenance dispatch systems. This holistic approach leads to preventive actions (fixing issues before they escalate) and improved operational efficiency.

Industry Outlook: The proliferation of IoT in agriculture and related sectors is a strong tailwind for Bonbloc's Edge Data solution. The global Agriculture IoT market is growing steadily as farmers adopt sensors, drones, and smart equipment to boost productivity and sustainability. In parallel, interest in smart agriculture and dairy is

fuelled by the need to feed a growing population efficiently; precision agriculture techniques are widely seen as key, and they rely on exactly the kind of data this platform gathers. Additionally, food safety regulations (like FSMA mentioned earlier) increasingly mandate environmental monitoring (for instance, continuous temperature logs for refrigerated foods), raising the bar for data management in cold chains. Bonbloc has highlighted that its IoT solutions help cut waste, for example, enabling end-to-end visibility of remote food storage conditions to minimize losses from spoilage which directly addresses a major pain point (the FAO estimates 14% of food is lost between harvest and retail globally). Beyond food and agri, the broader IoT trend in industry is explosive: the number of connected IoT devices worldwide is projected to reach 105 billion units by 2030, from 26.5 billion in 2020, and 48.8 billion units in 2024, growing at a CAGR of 13.6% with the USA being a significant contributor to this market. A significant share of those will be in industrial and agricultural settings. As these industries generate more edge data, the demand for platforms that can securely handle and make sense of that data will grow. Bonbloc's integration of blockchain also aligns with a trend of needing trust in IoT data (e.g. to verify that sensor readings haven't been tampered with). In summary, the agriculture, dairy, and fluid management sectors are all becoming more data-driven, and the robust growth of IoT solutions in farming and supply chains is set to drive adoption of Bonbloc's Edge Data Management. Companies seeking to optimize operations and comply with safety/quality standards will increasingly invest in such technology to harness their field data for better outcomes.

Trade Data Reconciliation

Value Proposition: Bonbloc's Trade Data Reconciliation solution uses AI and blockchain to identify and resolve data discrepancies in trade transactions. Whether it's mismatched purchase orders and invoices, shipment records not aligning with receipts, or payment records that don't match goods received, this tool automates the tedious process of cross-verifying documents across different systems and parties. The platform likely ingests structured and unstructured data from various sources (ERP exports, PDFs, emails) and uses a combination of rules and machine learning to flag inconsistencies (e.g. a vendor invoiced 100 units but warehouse logged 98 units received). Blockchain plays a role by providing a secure, shared ledger where transaction data and any adjustments or dispute resolutions can be recorded transparently for all authorized parties. The value proposition is a significant reduction in labor and cycle time for reconciliation, improved accuracy in financial records, and better cash-flow management. By swiftly catching errors like over-billings or omissions, companies can avoid overpayments and strengthen partner trust. In short, this solution transforms an error-prone, manual reconciliation process into an efficient, auditable workflow, giving companies confidence that their trade data is consistent and correct.

Use Cases: A core use case is in accounts payable and procurement: for example, a retailer receives thousands of supplier invoices and must match each to POs and delivery receipts. Traditionally, 3-5% of invoices might have errors requiring exceptions handling. Bonbloc's tool can automatically reconcile many of these, only escalating truly complex exceptions to staff. Another use case is logistics and freight reconciliation, ensuring that freight bills from carriers align with the contracted rates and actual shipment details. The solution could import shipping manifests, compare them to invoices and contracts, and detect overcharges like duplicate fees or incorrect fuel surcharges. In trade finance, banks and trading companies could use it to reconcile letters of credit, customs documents, and goods receipt information to facilitate quicker payments while meeting compliance (for instance, verifying all required documents in an import transaction match and are authenticated). For internal auditing, the platform provides a tamper-proof trail of any data corrections made and by whom useful for SOX compliance or regulatory audits. Overall, any organization dealing with high volumes of transactional data across different silos (sales orders vs. fulfillment vs. billing) can use this solution to achieve a single version of truth. A notable advanced use case is using AI to explain discrepancies (a capability hinted by Bonbloc's case studies): e.g. if a price discrepancy is due to an early payment discount not reflected on an invoice, the system could flag it and suggest that explanation, turning what was once a detective hunt into a straightforward review.

Industry Outlook: Virtually every industry is affected by data reconciliation challenges, but the push toward digitization is making automated reconciliation a priority. The global trade finance market, as one indicator of cross-border trade operations, is projected to grow modestly from US$52 billion plus in 2024 to $70 billion by 2030, reflecting steady expansion of international trade (and thus more trade data to reconcile). More telling is the inefficiency currently present: many businesses see errors in their invoices, and the cost of manual exception handling is substantial, often estimated at a few times the cost of error-free processing once rework is factored in.

This has led to rising interest in *"autonomous finance"* and AI-driven back-office solutions. The market for financial process automation and supply chain management software is also growing as companies invest in systems that can talk to each other and reconcile data in real time. Additionally, the complexity of global supply chains (multiple systems, EDI messages, partners in different IT ecosystems) practically necessitates a blockchain-based reconciliation layer to serve as an authoritative record. Bonbloc's solution is aligned with these trends: it uses AI to cut through data silos and blockchain to establish trust. As industries continue to digitize procurement and financial workflows and as CFOs focus on working capital optimization (which depends on accurate payables/receivables data), the demand for automated reconciliation tools will grow. Bonbloc's Trade Data Reconciliation stands to gain from this, offering a modern approach to an age-old pain point, and turning what used to be weeks of back-and-forth into a near-instant process. Reducing manual reconciliation not only saves costs but also enables faster error discovery, which can improve supplier relationships and financial agility. These benefits are increasingly recognized, making automated reconciliation a key component of digital transformation roadmaps in many large enterprises.

Digicity

Value Proposition: Digicity is Bonbloc's holistic smart city and e-governance platform, designed to digitize and connect various city services and administrative functions. It likely provides a blockchain-backed framework for city governments to manage everything from citizen records and permits to public asset registries and service delivery, all in a unified, secure system. By implementing Digicity, municipalities can replace fragmented legacy systems with a coordinated digital infrastructure, resulting in streamlined workflows and greater transparency for residents. For example, Digicity could enable a resident to apply for a business license or housing permit online, have it routed through the necessary approvals automatically, and securely store the final permit on a blockchain where it can be verified by any agency or bank that needs proof. Simultaneously, it might integrate smart city data (traffic sensors, energy usage, waste management data) to help local administrators make data-driven decisions about city operations. The platform emphasizes interoperability and trust: data silos between departments are broken down, and blockchain ensures data integrity and auditability for sensitive public records. Ultimately, Digicity's value is in helping cities become more efficient, responsive, and citizen-centric improving services like urban planning, utilities, and community programs through digital technology.

Use Cases: Digicity's use cases span multiple facets of city administration. A prime use case is e-governance portals: citizens can interact with local government digitally, paying taxes, registering properties (tying in with the Property Registration module), filing grievances, or requesting services with all transactions logged immutably. Another use case is in affordable housing programs: the platform can manage applications, track allocations, and maintain transparent waitlists or subsidy disbursements, reducing corruption and ensuring the intended beneficiaries are served. In the realm of city infrastructure, Digicity might integrate IoT sensor networks (smart lighting, traffic flow sensors, utility meters) and use AI analytics to optimize city services (e.g., adjust street lighting based on usage data or manage traffic signals dynamically to reduce congestion). The system can also facilitate public safety and emergency coordination as part of a smart city approach, linking with Bonbloc's Emergency Management solution to provide city-wide situational awareness. For instance, during a city event or disaster, Digicity could help coordinate between police, fire, hospitals, and public information channels to guide citizens. Additionally, Digicity could enable open data initiatives, where certain city data (budgets, project statuses) are published on a blockchain ledger for accountability to citizens. This fosters trust and civic engagement by giving the public a clear window into government operations. Essentially, use cases range from administrative efficiency (cutting red tape via digital workflows) to smart urban management (leveraging IoT and data to improve quality of life).

Industry Outlook: The drive toward smart cities is a major global trend as urban areas seek sustainable, tech-enabled growth. The global smart cities market is enormous and expanding fast, and is expected to grow from about US$700 billion in 2024 to $1.7 trillion by 2030 (16% CAGR). Governments worldwide are investing in smart city initiatives: from developed nations modernizing aging city systems to developing countries leapfrogging with new digital city projects. For example, programs like India's Smart Cities Mission and similar initiatives in the Middle East and China are allocating substantial budgets for urban digital infrastructure and

governance platforms. A core component of these projects is improving e-governance and public service delivery through technology. Moreover, increasing urbanization (over two-thirds of the world's population will live in cities by 2050) is straining conventional city management necessitating efficient digital systems to handle the load of civic administration. Bonbloc's focus on blockchain in city admin aligns with a subset of this trend: ensuring trust, security, and inclusivity in digital governance. Notably, solutions that address affordable housing allocation, land management, and citizen digital identities are garnering attention because they tackle urban challenges of equity and transparency. Bonbloc's mention among Hyperledger members specifically highlighted their pursuit of public service blockchain solutions like housing and city administration, validating that this is seen as a valuable frontier. As cities around the globe continue to modernize, the growth in smart city tech and the emphasis on good governance will drive demand for Digicity. City governments will need platforms that can integrate multiple services and datasets, and do so securely, precisely what Digicity offers. In an era where citizens expect digital convenience from government just as they do from retail or banking, a platform like Digicity can be pivotal in transforming municipal operations, making it a timely offering in the booming smart city market.

1.17. Threats and Challenges to the Growth of AI, IOT & Blockchain related Product / Services

Emerging digital services including AI, IOT and Blockchain related services is a highly competitive and fast-evolving market and the segment faces both external market pressures and internal execution risks. The following outlines these factors, with attention to the global contexts.

Internal Risks

Delivery Execution & Integration Complexity: Customized enterprise deployments require complex integration with legacy ERP, warehouse and IoT systems. Coordinating such rollouts globally risks delays or overruns, as each client's processes and data formats differ.

Talent Acquisition & Retention: Competing for skilled blockchain, IoT and AI engineers is difficult. There is a known shortage of qualified "digital, technical and data science" talent. Vendors need to attract and retain experts in emerging tech (e.g. data scientists, DevOps, security specialists) to maintain platform performance and innovation, or else its execution and support quality could suffer.

Platform Reliability: As a SaaS provider, vendors must sustain 24×7 operations under strict SLAs. Any outages or performance bottlenecks can erode customer trust and lead to churn.

External Risks

Regulatory & Compliance Changes: Targeting highly regulated markets (pharma, food, government) and ongoing regulatory shifts like ones in pharmaceutical / food traceability can create uncertainty. For example, the FDA recently began full DSCSA enforcement, revealing widespread data issues: even minor discrepancies in serialization data can trigger product holds, and dispensers report integration bottlenecks in pharmacy systems. Similarly, FSMA's new traceability rule which mandates sharing specific tracking data for high-risk foods is being extended, as many firms struggle to coordinate with supply chain partners and provide accurate data. In public-sector procurement, evolving data-security regulations and slow approval cycles further complicate adoption. Strict traceability mandates (DSCSA, FSMA) mean vendor's solutions must flawlessly capture and share data across partners, a high bar given industry struggles with data completeness and system integration.

Competitive Pressures & Pricing: The enterprise traceability and IT-services markets are crowded. Vendors compete against large tech integrators and specialized blockchain/IoT startups. Larger players may undercut pricing or bundle services, pressuring margins. At the same time, demanding customers expect high functionality at SaaS-like pricing, squeezing opportunities for premium margins on custom deployments.

Buyer Adoption Cycles & Data Quality Dependencies: Slow industry adoption and interoperability gaps could also be major hurdles. Besides, clean data flowing from clients' suppliers and partners is critical. If customers fail to feed high-quality serial and IoT data into the system, traceability will be patchy and clients may blame the platform rather than upstream partners.

Security and Trust Demands: If the business requires processing highly sensitive data (drug lots, food origin, government records), customers will insist on ironclad security, compliance certifications and data privacy controls. Vendors must continuously invest in cybersecurity to meet these demands. Heightened security and privacy are critical.

Cloud Costs: While the vendors rely on cloud infrastructure and third-party platforms, these cloud costs are unpredictable. Customers may not be happy with expensive cloud-based fees or seek on-premise options. Rising cloud bills could squeeze margins unless tightly controlled.

Macroeconomic Uncertainty: Vendors are exposed to economic cycles. In downturns, clients may cut IT projects or delay upgrades. Inflation and currency fluctuations could raise operational costs. Global supply chain disruptions can also indirectly impact traceability demand: if customers themselves are struggling, they may postpone compliance investments.