Forecast Analysis: Enterprise and Automotive IoT Platforms, Worldwide

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Initiatives: Technology Market Essentials

The enterprise and automotive IoT platform market will represent an $11.3 billion opportunity in 2025, up at a 33% CAGR from 2020. By the end of the forecast period, the largest revenue sectors will be manufacturing and natural resources, transportation, and building automation.

Overview

Forecast Assumptions

- The average Internet of Things (IoT) platform investment in connected cars and trucks will increase from $3 per vehicle per year in 2020 to almost $7 per vehicle per year in 2025.
- As product-as-a-service offerings continue to proliferate, OEM spending on IoT platforms for connected products will increase from 22% of sales to 26% in 2025.
- As healthcare benefits from postpandemic spending and aging populations, platform penetration in hospital clinical data collection will increase almost three-fold from 2020 through 2025.

Market Impacts

- Total IoT platform spend in automotive and heavy trucks, by a combination of OEMs and fleet operators, will increase at a 41% compound annual growth rate (CAGR) to $2.4 billion in 2025.
- Connected products as a whole represent the largest IoT platform use case (this includes OEM investments for connected cars and trucks), growing to $2.9 billion in 2025.
- Investment in IoT platforms for connected healthcare saw a boost in spending as a result of the pandemic and will reach a global spending level of $412 million in 2025.

Notable Changes

This is an update of the 2020 iteration. There have been two major methodology changes to the forecast in 2021:

- We have collected all spending by OEMs in a new connected product use case, which is grouped under the manufacturing and natural resources sector. As a result, this sector represents a larger proportion of spending than it did in the 2020 publication. The spending for all other use cases, outside of the connected product use case, is associated with end-user organizations deploying these use cases (remaining in the original sector). Consumer automotive does not appear in the sector list because all spending for consumer automobiles is done by OEMs, and hence is collected in the connected product use case under manufacturing and natural resources. Total automotive spending, including OEM and commercial end-user spending, is provided in Tables 1-6 and 1-7 of Forecast: Enterprise and Automotive IoT Platforms, Worldwide, 2019-2025.
- Usage of IoT platforms in automotive products has been added to the forecast scope. End-user spending on IoT platforms for commercial automobiles has been included in the newly added commercial automotive sector, and spending by OEMs has been added to the new connected product use case.

Forecast Data Summary

Figure 1 shows total worldwide enterprise and automotive IoT platform spending, and Figure 2 shows this spending by sector.

Figure 1: Enterprise IoT Platform Spending, Worldwide (Billions of Current Dollars)

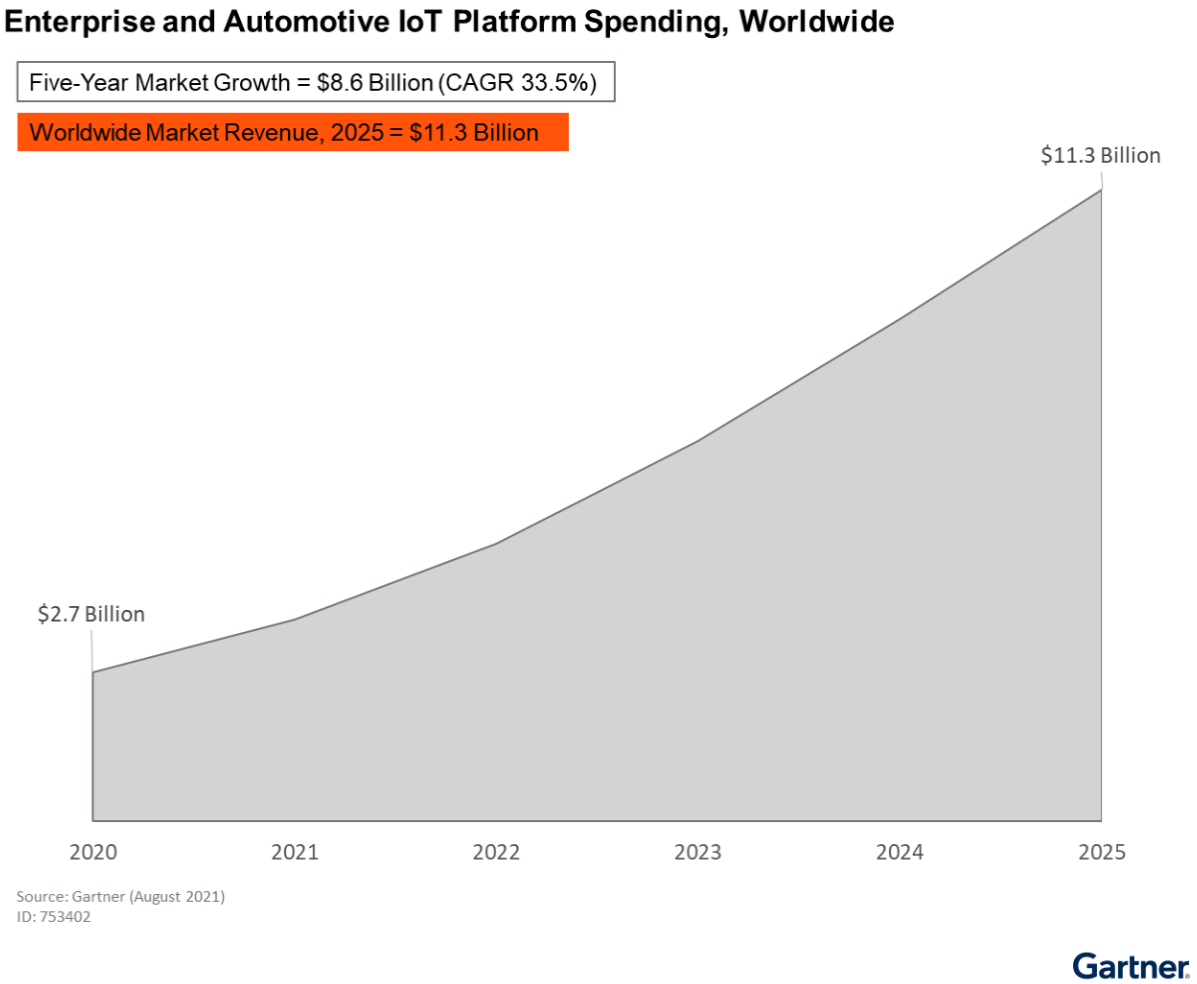
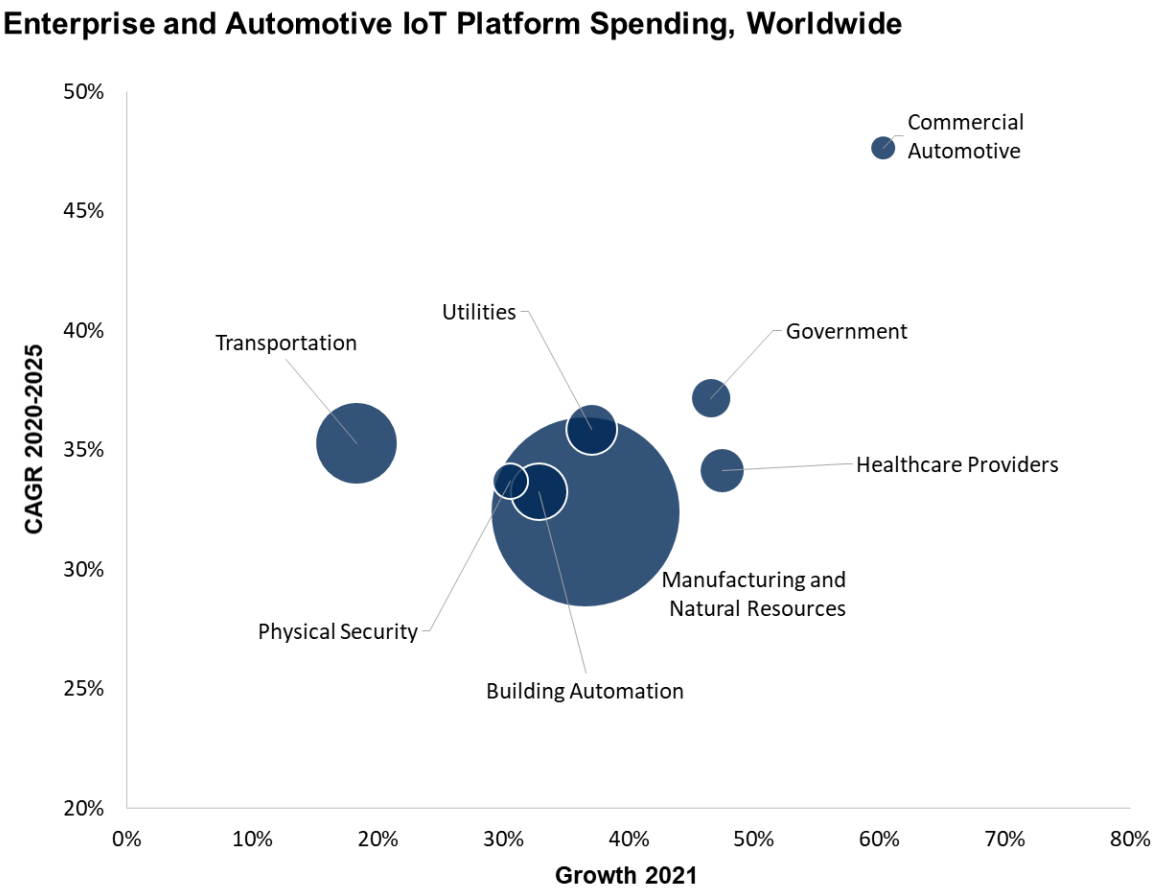


Figure 2: Enterprise and Automotive IoT Platform Spending by Sector, Worldwide Revenue (Billions of Current Dollars)



Note: The size of each bubble represents 2020 enterprise and automotive IoT platform spending by sector in current U.S. dollars.
Source: Gartner (August 2021)
ID: 753402

Gartner

Table 1 shows IoT platform spending by use case (for use-case definitions, see Market Definitions and Methodology: Internet of Things Forecast).

Table 1: Total IoT Platform Spend by Use Cases, 2020-2025 (Millions of Current Dollars)

(Enlarged table in Appendix)

Use Case	2019	2020	2021	2022	2023	2024	2025	CAGR 2020-2025
Connected Product	469	584	859	1,231	1,727	2,320	2,928	38.1%
Manufacturing Process Automation	610	727	934	1,175	1,514	1,919	2,362	26.6%
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Mine Operation	115	136	191	269	371	488	617	35.3%
Connected Aircraft Management	193	116	123	199	342	480	598	38.9%
Commercial HVAC Management	88	100	131	184	251	329	423	33.5%
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Hospital Clinical Data Collection	26	41	61	85	114	153	198	37.3%
Connected Car — Commercial	18	25	41	63	95	135	178	47.5%
In-Building Transportation	42	44	57	79	103	132	162	29.9%
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Other	195	239	332	459	614	796	993	32.9%
Total	**2,335**	**2,661**	**3,594**	**4,947**	**6,784**	**8,944**	**11,266**	**33.5%**

Source: Gartner (August 2021)

Enterprise IoT Platform Definition

Gartner defines the IoT platform market as a set of integrated software capabilities to improve product or asset management decision making and operational visibility and control. These capabilities may be deployed on the edge, in the cloud or in a hybrid model. This analysis focuses on the enterprise and automotive markets and excludes the home consumer markets.

The IoT platform comprises the following technology functions:

- **Analytics:** Processing of data streams such as device, enterprise and contextual data to provide insights into the asset state by monitoring use, providing indicators, tracking patterns and optimizing asset use. A variety of techniques, such as rule engines, event stream processing, data visualization and machine learning, may be applied.
- **Device management:** Software that enables manual and automated life cycle management tasks to create, provision, configure, update, troubleshoot and manage fleets of IoT endpoints and gateways remotely, in bulk or aggregate, and securely.
- **Integration tools and management:** Software, tools and technologies, including communications protocols, APIs and application adaptors, which minimally address the data, process, enterprise application, IoT endpoint and IoT ecosystem integration requirements across cloud and on-premises implementations for end-to-end IoT solutions.
- **Data management:** Capabilities that support ingesting IoT endpoint data, storing data from edge to enterprise platforms, providing data accessibility, tracking lineage and flow of data, and enforcing governance policies to ensure the data quality, security and privacy.
- **Application enablement and management:** Software that enables business applications in any deployment model to analyze data and accomplish IoT-related business functions. Core software components manage the OS and standard input-output or file systems to enable other software components of the platform. The application platform (for example, application platform as a service [aPaaS]) includes application-enabling infrastructure components, application development, runtime management and digital twins.
- **Security:** The software, tools and practices to facilitate audits, ensure compliance, and establish and execute preventive, detective and corrective controls and actions to ensure privacy and the security of the data across the IoT solution.

The forecast presents spending for the IoT platform market based on the upfront software license fees and per-seat fees most companies pay the technology vendors, as well as the per-asset platform as a service (PaaS) subscription fees.

IoT Drives a New Wave of Innovation

IoT-enabled solutions can span platforms, with most including computing on devices, edge controllers and servers, cloud hubs, and enterprise back ends. The design of such staged solutions demands platform technologies of greater agility and openness.

Increasingly, business requirements force organizations and the technology providers serving them to adopt more robust technical capabilities and architectures, such as:

- Event streams — IoT action is typically initiated from devices emitting a stream of signals. All platforms participating in IoT solutions must be equipped to process event streams, raising the profile of event stream processing and event brokering technologies.
- Pipelines — The processing of the event stream includes a sequence of ingestion, data quality and integration, rules, statistics, descriptive, predictive and prescriptive analytics, decision making, and command invocation. Most of these jobs are performed by tools that are also used for objectives other than IoT. Therefore, the notion of an IoT platform becomes essentially a pipeline of tools created and used independently. That's quite different from traditional platforms, which are designed to operate in a tightly integrated manner.
- Cascading — Device-initiated event streams travel through the stages of the IoT solution. The analysis pipeline is applied at each stage, though the data becomes increasingly concentrated and includes greater context and scope. The participating platforms must be able to apply similar processing at increasing and decreasing scales, thereby promoting flexible platform design that can operate on system infrastructures of differing computing powers.
- Edge — IoT work starts at the edge. That's where the initial analysis, data cleansing and concentration, event processing, and urgent action orchestration take place. The edge is neither the cloud nor the data center, and it requires its own platform design, capabilities and architecture. It also imposes new requirements and investment efforts on the cloud-based platforms that are often called to monitor, manage and support edge operations.

- **Digital twins —** Digital twins are digital representations of physical objects. To facilitate the interaction of the physical and digital worlds, many IoT solutions deploy the architecture of digital twins. A digital twin may include various forms of static and dynamic data, analytics, artificial intelligence (AI) and other algorithms, rules, integration connectors, process routines, and controllers. Some leading organizations extend the use of the digital twin architecture and tooling to represent abstract entities such as purchase orders or supply chain logistics status. Such digital twins become bounded and autonomous microapplications. Digital twins require a parallel governance and data management policy to IoT solutions.

Managed Edge Platforms

All major cloud platform vendors support the IoT, and many have recognized the growing shift of IoT processing to the edge. Amazon Web Services (AWS) and Microsoft Azure, among others, now sell software that is designated for deployment at the edge and is specialized for IoT work, although the vendors have different strategies for running on-premises disconnected versus “tethered” to their cloud IoT platforms for versioning and coordinated processing.

IoT Platform Forecast Analysis

IoT platform technology is applicable across all vertical and cross-industry sectors to varying degrees. The biggest sectors, based on 2025 spending, will be manufacturing and natural resources, transportation, building automation, and utilities. Collectively, these areas represent over 85% of the total spending opportunity in 2025. This is because platform technology is very useful in situations involving machinery and complex systems, helping to orchestrate operations and monitor the state of constituent parts.

The primary change to the forecast trend relative to the initial IoT platform forecast published in early 2020 was to account for the impact of the COVID-19 pandemic. Growth slowed to 14% in 2020, below the expected prepandemic level of over 30%. Hardest hit was transportation, declining 20%, whereas healthcare (56% growth) and physical security (43%) fared best. From 2020, overall growth recovers with the economy, and a robust 33% CAGR is expected through 2025.

In manufacturing, the connected product and process automation use cases dominate spending, but platform technology is also employed in supply chain tracking, facilities management, and asset tracking and parts replenishment. Construction monitoring is another substantial opportunity. In natural resources, the most significant use case is mine operation, but oil and gas extraction, agricultural equipment tracking and precision crop farming are also significant opportunities. Other use-case applications include livestock management.

In transportation, heavy vehicle management provides the greatest opportunity, including aircraft, buses, trains and ships. However, due to the steep decline in travel during the COVID-19 pandemic, the spending on heavy vehicle management will not exceed 2019 levels until 2022. Particularly hard hit was connected aircraft management, dropping 40% in 2020. Beyond vehicles, there are opportunities in various logistics and infrastructure management use cases.

In utilities, opportunities exist at different points of smart grid networks, with electricity and, in particular, grid-scale generation and smart metering representing the biggest value. With generation, the platform opportunities are focused on optimizing the use of generating assets, which are transitioning to more environmentally friendly energy sources. Smart meters, in the distribution layer, are employed at commercial and residential premises, representing a large volume opportunity. The latter requires platform technology with the ability to scale effectively as deployments reach into the hundreds of thousands or millions of meters.

In the building automation sector, which applies across vertical industries, IoT platforms will facilitate the management of HVAC systems and in-building transportation systems, such as elevators, escalators and moving walkways. In addition, they will be used to manage connected lighting systems.

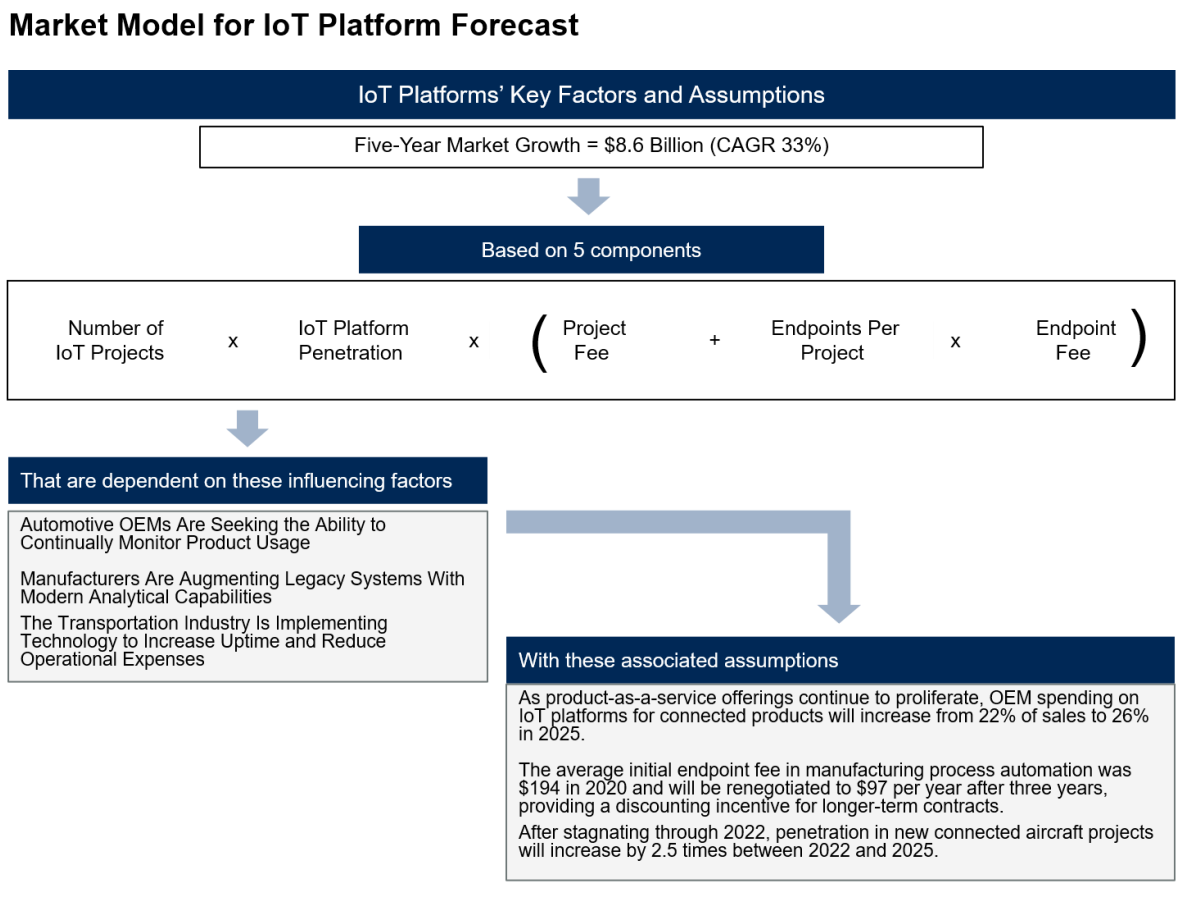
Beyond the top verticals, there are other significant use cases. These include street and outdoor lighting, hospital clinical data collection and chronic condition management in healthcare, building intruder detection and indoor surveillance in physical security, and a variety of retail use cases.

Forecast Model Summary

The IoT platform forecast is based on the IoT use case and endpoint forecast (see Internet of Things Forecast Database). For each use case, the number of potential projects is assessed based on the overall installed base of endpoints employed in each use case and an assumed average project size. These factors can vary over the course of the project and by the nature of the use case. We then forecast the attach rate of IoT platform software to such projects. For each project, the client organization can be charged an annual fee associated with the project overall (licensing, training and ongoing maintenance), and/or an annual fee associated with each endpoint managed in the project. This per-endpoint fee represents the PaaS component of the forecast.

Figure 3 summarizes the key components, influencing factors and forecast assumptions that drive the IoT platform forecast.

Figure 3: Market Model for IoT Platform Forecast



Source: Gartner (August 2021)
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Influencing Factors and Assumptions

> **Automotive OEMs Are Seeking the Ability to Continually Monitor Product Usage**
>
> We expect that IoT platform technology will steadily proliferate into automobile models as OEMS see the utility in continuing to invest in its deployment. OEMs' refresh of their model lines will give them the opportunity to augment these lines with additional hardware and software technology backed by operational data.

Forecast Assumption: The average IoT platform investment in connected cars and trucks will increase from $3 per vehicle per year in 2020 to almost $7 per vehicle per year in 2025.

New — By incorporating IoT platform technology in their product lines, automotive OEMs gain insight into the conditions under which their products are operated, and the ability to monitor how these systems are responding in the real world. This is a great advantage over the limited insights that could historically be gained from nonconnected automobiles. Such information will feed into the design evolution of future models by giving engineers a window into system and subsystem performance and interaction. Product managers will gain valuable data on vehicle usage patterns to help them plan features for the next generation. In other words, IoT platforms contribute to the end-to-end engineering life cycle management of these highly complex products by providing contextual operations data. They can also be used to demonstrate compliance with regulatory and industry standards. As a result, automotive OEMs will gain greater synergy insight across design, manufacturing and operations phases of the product life cycle.

In some instances, the baseline platform technology will be augmented by the incorporation of digital twin software, which bridges the gap between physical and digital representations of the products.

Aggregate analysis of operational parameters, such as engine speed, fuel/air mix, oil temperature and pressure, fluid levels, exhaust parameters, tire pressure, and safety systems, together with data on weather and traffic conditions, can be used to help:

- Increase fuel economies
- Increase reliability
- Customize maintenance schedules
- Provide a better driving experience

Analysis can lead to insights on operational interaction between subsystems that could not otherwise be derived.

The platform proliferation trend will be buoyed by the continued growth of advanced technologies, such as drive-train electrification, new safety systems and autonomous driving technology. OEMs will push the technology deeper into product lines, with the resulting economies of scale leading to a virtuous cycle.

> **Product Companies Are Seeking to Add Value-Added Services to Their Portfolios Via IoT Technology**
>
> The technology functions of IoT platforms, including analytics, device management integration tools, data management, application management and security, are well-suited to enable product OEMs to gain insights into customer usage. This allows them to package insights into service offerings that create an ongoing revenue stream to the OEM.

Forecast Assumption: As product-as-a-service offerings continue to proliferate, OEM spending on IoT platforms for connected products will increase from 22% of sales to 26% in 2025.

New — Different stakeholders can invest in IoT platforms: connected product OEMs or end users (IoT system operators). The connected product use case corresponds to the OEM portion of the investment, whereas all other use cases in the forecast represent investment by end users. For example, the connected product spending could represent the manufacturer of an automobile (among other products). However, the “connected car — commercial” use case could correspond to spending by a fleet operator (that is, end user), leveraging IoT platform software to help orchestrate operations and improve efficiency.

Connected product OEMs invest in the technology to monitor the conditions under which their products are used (to assist with future product iterations, warranty coverage and predictive maintenance; deliver software updates; offer in situ upgrades; and provide value-added services to their clients).

Over time, the OEM share of spending is expected to increase, primarily driven by high-growth automotive applications, which form about three-quarters of the connected product category. This will also help facilitate growth in value-added services and product-as-a-service offerings, which will drive OEM investment as assets under management increase (with these vendors paying a fee per asset managed).

> **Manufacturers Are Augmenting Legacy Systems With Modern Analytical Capabilities**
>
> Manufacturers have been investing in networked automation equipment and software tools (such as manufacturing execution systems) for many years. They see the potential of improving operational efficiencies through the use of modern IoT technologies. However, in many cases, upgrades are complicated by the need to source products that can work alongside initial investments (for example, the convergence of IT and operational technology [OT]). IoT platform software targeted at the manufacturing industry has been designed to do this. Nevertheless, projects can be complex to implement.

Forecast Assumption: To attract new adopters as the technology proliferates, the average upfront licensing fee for manufacturing process automation projects will decrease from $445,000 in 2020 to $334,000 in 2025.

Updated — The focus of this use case is on using IoT to fully automate manufacturing sites, which reduces operational costs and improves quality control. The use case includes the use of robots, sensors, actuators, specialized manufacturing machinery and process equipment, and other IoT elements to realize a fully automated factory that minimizes human intervention in the manufacturing process. IoT platforms are leveraged to manage the machinery and data acquisition systems to help modernize existing facilities and form the backbone of new implementations.

Manufacturing applications tend to be complex, multitier applications (for example, as described by the ISA-95 standard). The lowest tier represents the physical layer of the system, including sensors and actuators. These are overseen by a control layer composed of programmable logic controllers. The upper management tier provides oversight at a total factory or complex assembly/process line level.

The IoT platform software must be able to support such topologies if it is to be applicable; hence, initial bring-up and support of ongoing operations are challenging. Multivendor environments, particularly “brownfield,” with varying technological vintages, will present a key challenge to platform providers and system integrators.

Some of the features clients will require of these applications include:

- Flexible, distributed compute architectures
- Support for industrial communications technology such as Fieldbus protocols
- Ability to coexist with legacy software such as data historians

- Ability to interact with and configure a range of assets from different automation equipment manufacturers
- Support for analytics and optimization, including advanced machine learning and AI-based analytics

As adoption in platform usage ramps up over time, technology providers will encourage the remaining untapped industrial end users to adopt IoT platforms by lowering the upfront fee over time. This flexibility to lower the fee will be enabled by increasing experience and amortization of development expenses over a larger user base.

Forecast Assumption: The average initial endpoint fee in manufacturing process automation was $194 in 2020 and will be renegotiated to $97 per year after three years, providing a discounting incentive for longer-term contracts.

Updated — The average deployment will have about 1,000 devices once fully implemented. These devices will support decision making and analytics by collecting sensor and actuator state data. The decision framework is aligned with the multitier architecture in the previous forecast assumption. In many cases, such systems can collect massive amounts of real-time data via high-frequency sensor sampling or position/state sampling. The data undergoes a filtration and reduction process in which steady-state and normal-state readings are compressed or filtered, and analytical effort is focused on deviations from setpoint target bands.

The ongoing per-unit fee provides continuous access to platform software, security updates and incremental feature sets. Depending on the level of fees paid, the services supplied in exchange for the ongoing fee will open up additional advanced options and enhancements in the software. On average, customers will be able to renegotiate pricing after three years, providing a loyalty benefit to customers as providers offset the unit price reduction with growing project scales (for example, the addition of more endpoints under management over time). In other words, individual projects will tend to grow in scale as they mature, enabling platform providers to discount pricing.

The Transportation Industry Is Implementing Technology to Increase Uptime and Reduce Operational Expenses

IoT platforms can play a key role in continual process improvement in the transportation industry. Platform capabilities in analytics, data management and business application enablement can be used to leverage operational state and sensor data. By periodically revisiting past practices using modern toolsets, additional efficiency can be wrung from transport systems, recouping the investment in the platform technology and increasing profitability, while adhering to safety standards and regulations.

Forecast Assumption: After stagnating through 2022, penetration in new connected aircraft projects will increase by 2.5 times between 2022 and 2025.

New — This use case deals with aircraft that are networked for a range of uses, including essential operational systems and maintenance. The connection is made via air-to-ground and satellite communications. In addition, detailed flight data may be transferred on landing. IoT platforms can be used to manage and orchestrate the flow of data from the aircraft's sensors and avionics to systems responsible for maintenance, flight operations and engineering development. End users of the platform software will typically pay an annual fee per asset managed, so the fee structure grows with the size of the fleet being overseen.

Maintenance operation benefits from the use of platform technology via the tracking of flight and operational conditions, which may affect the life span of consumable parts or the airframe itself. The platform may be augmented by digital twin systems and predictive maintenance packages that can tailor the repair and replacement schedule to the individual aircraft. Parts and logistics software helps manage and forecast the needs for each type of spare, reducing overall inventory needs and reducing costs further.

Operational data collected from flights can be examined using analytics packages to discover ways in which aircraft operation can further be optimized. Potential resultant benefits include reduced delays, better fuel economy, environmental benefits, potentially less wear on parts and reduced failure rates. The data and insights can also be used to help improve the design of the next generation of airframes, avionics and engines, and can be leveraged to provide midlife upgrades on the original designs.

Healthcare Impact of the Pandemic Aftermath/Aging Populations

Healthcare systems in many countries have been significantly strained by the pandemic. The timing of the recovery coincides with population aging in many countries, which challenges budgets and necessitates efficiencies in the running of the healthcare system.

Forecast Assumption: As healthcare benefits from postpandemic spending and aging populations, platform penetration in hospital clinical data collection will increase almost three-fold from 2020 through 2025.

New — IoT applications have been proliferating in healthcare, opening up additional opportunities for IoT platforms. Early IoT applications involved connecting sophisticated, expensive, imaging devices, such as MRIs and CT scanners, to a network. Over time, connectivity will be added to medical equipment, such as blood pressure monitors and blood oximeters, with a lower unit cost. Additionally, as costs drop, adoption will occur in emerging markets and less affluent economies, with market inflection at lower price points.

IoT platform technology can serve a number of roles in the hospital environment, spanning use cases from:

- People tracking
- Medicine and consumable inventory management
- Equipment location systems
- Management of the influx of data from diagnostic tools and instrumentation
- Integration of the device networks with back-end IT systems, cloud infrastructure and advanced analytic systems, such as machine learning and AI.

The COVID-19 pandemic overwhelmed healthcare systems around the world and forced rapid transition to digital services. In the aftermath, digital, having proved its efficiencies, will continue to proliferate.

Connected healthcare systems offer a number of benefits, including:

- Greater accuracy of recorded information and reduced errors (with improved traceability and regulatory compliance)
- Better inventory control of medicines and critical supplies
- Time savings and cost reductions
- Improved patient safety and potentially better health outcomes, expanded scope of recovery at home and reduced hospital readmittance rates
- Greater holistic integration of medical diagnostics systems

- More continuous patient condition monitoring (for example, en route to the hospital, in the emergency room, in the hospital wards and, potentially, during recovery at home)
- Preventive/predictive maintenance on medical equipment

Document Revision History

Forecast Analysis: Enterprise IoT Platforms, Worldwide - 20 April 2020

Recommended by the Authors

Some documents may not be available as part of your current Gartner subscription.

Forecast: Enterprise and Automotive IoT Platforms, Worldwide, 2019-2025

Internet of Things Forecast Database

Market Definitions and Methodology: Internet of Things Forecast

Table 1: Total IoT Platform Spend by Use Cases, 2020-2025 (Millions of Current Dollars)

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