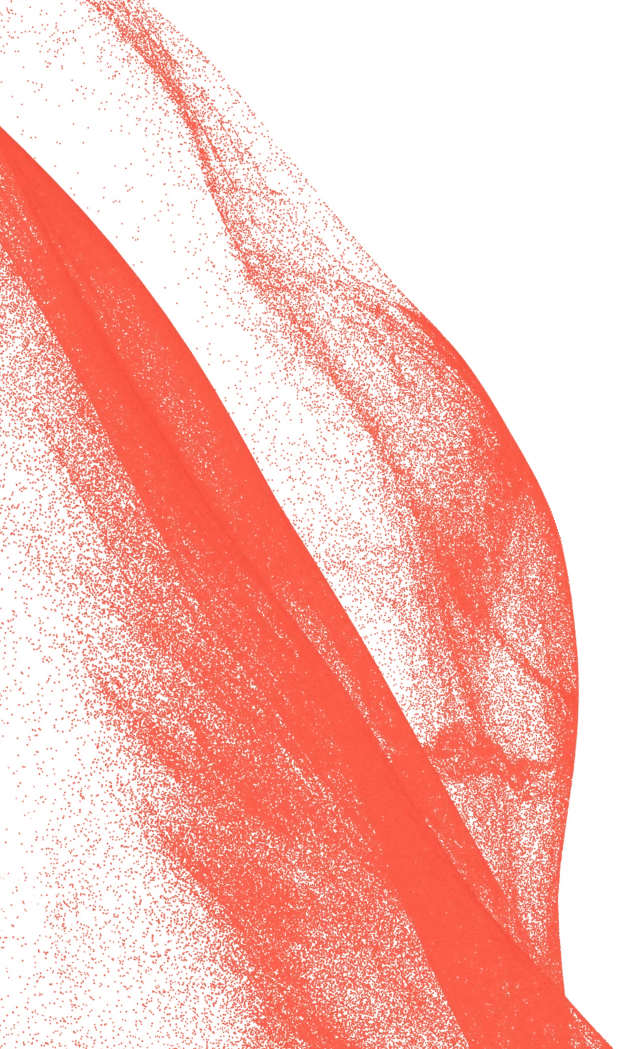

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WHITEPAPER

A Study of Distributed AI, Digital Thread, and Generative AI for Smart World Industry

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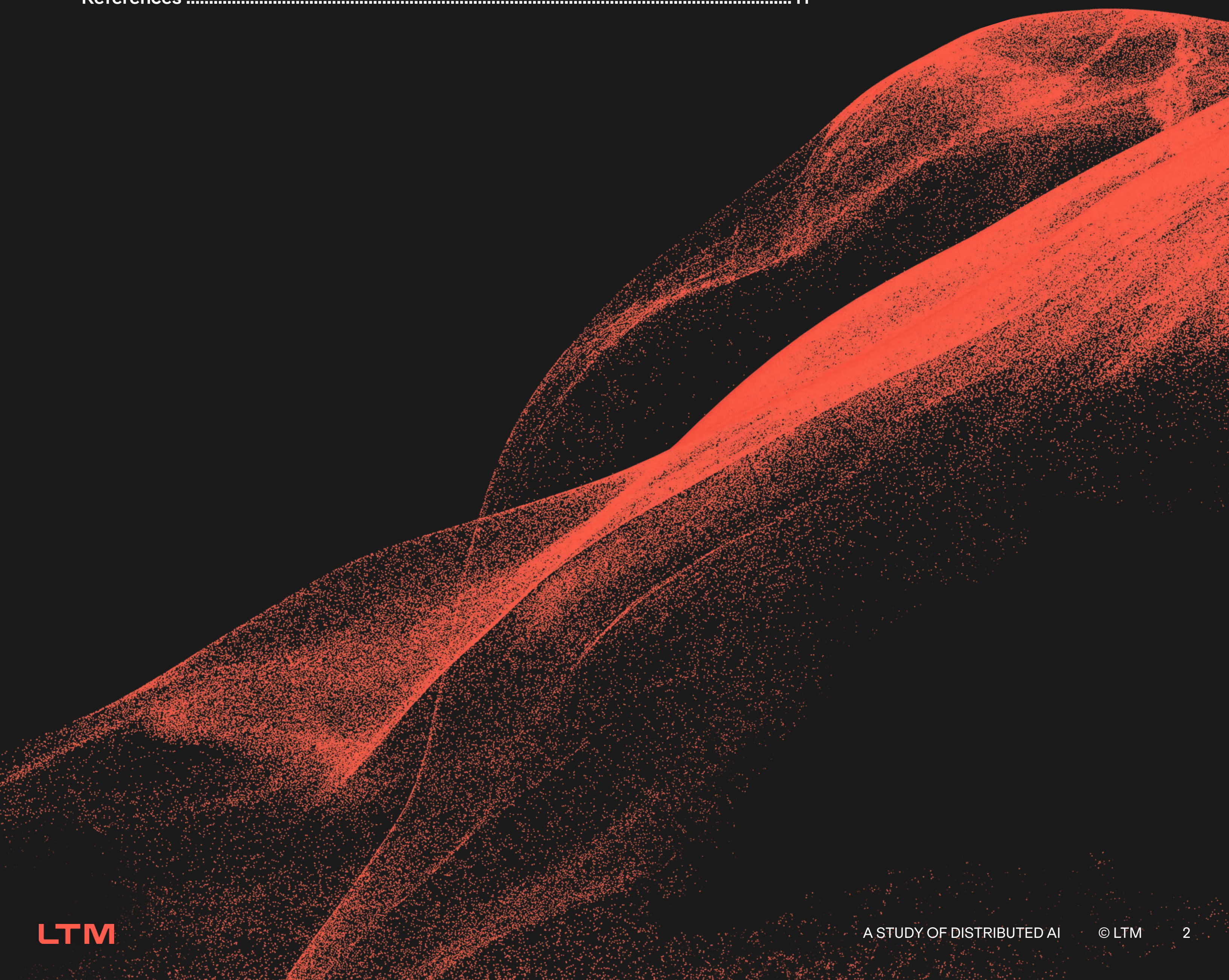


Executive Summary

In today's society, people make extensive use of technology, which has advanced significantly over time. These advancements have led to a global transformation across industries such as medicine, agriculture, and electronics. Among the next generation of technologies, **Distributed AI, Digital Thread, and Generative AI** are emerging as key enablers of this shift. They already have a significant influence on global trade and are expected to play an even greater role in the coming years.

Distributed AI, particularly in the form of edge artificial intelligence, represents a paradigm where AI processes are distributed across centralized data centers and devices located closer to users and physical environments. This approach addresses the limitations of conventional cloud-based systems, such as latency and dependency on centralized infrastructure. By enabling faster insights, improved security, and localized decision-making, Distributed AI helps organizations move toward more efficient and responsive operations, effectively allowing them to Outcreate traditional, centralized models of computing.

Digital Thread, on the other hand, provides a virtual representation of an object or system across its entire lifecycle. It continuously evolves using real-time data and integrates simulation and machine learning to support decision-making. This capability is increasingly applied in areas such as power generation, healthcare, and urban planning. By connecting data across stages, Digital Thread enables organizations to move beyond siloed operations and **Outcreate fragmented, disconnected ways of managing lifecycle data.**

Generative AI focuses on creating new content, such as text, images, and audio, based on existing data. Technologies like Generative Adversarial Networks (GANs) and Transformers enable machines to generate realistic and contextually relevant outputs. These capabilities are being adopted across industries to enhance innovation, personalization, and automation. As a result, organizations are able to **Outcreate traditional approaches to content generation and data utilization,** unlocking new possibilities for scale and creativity.

Individually, each of these technologies offers significant value. However, their combined application creates a more powerful ecosystem that supports smarter decision-making, operational efficiency, and innovation at scale. As organizations continue to adopt these technologies, the focus will shift from isolated implementation to integrated transformation, where human insight and intelligent systems work together.

This convergence reflects a broader shift toward **Business Creativity,** where enterprises move beyond incremental improvement to redefine how they operate and compete. In this context, organizations are not just improving within existing systems, they are beginning to **Outcreate the market itself.**

Introduction

Technology is the application of scientific knowledge for practical purposes with the objective of increasing production capacity, enabling scientific investigation, and improving efficiency. It brings together processes, tools, and information exchange to promote development and improve quality of life. In the 21st century, technology has become deeply embedded in day-to-day activities, influencing both personal and professional environments.

Education and communication systems, for instance, have become more advanced through platforms such as Byjus, Vedantu, Zoom, Skype, Microsoft Teams, and Google Meet. These tools have transformed how individuals learn and interact. From setti8ng a morning alarm to switching off lights at night, technology plays a continuous role in everyday life, creating a sense of convenience and security.[i]

At a broader level, emerging technologies are shaping global markets and business strategies. The Emerging Technologies and Trends Impact Radar highlights key innovations that have the potential to disrupt industries. These trends are centered around themes such as the smart world, productivity revolution, ubiquitous connectivity, and transparent security. The technologies that are expected to shape the coming decades are illustrated in Fig. 1[ii].

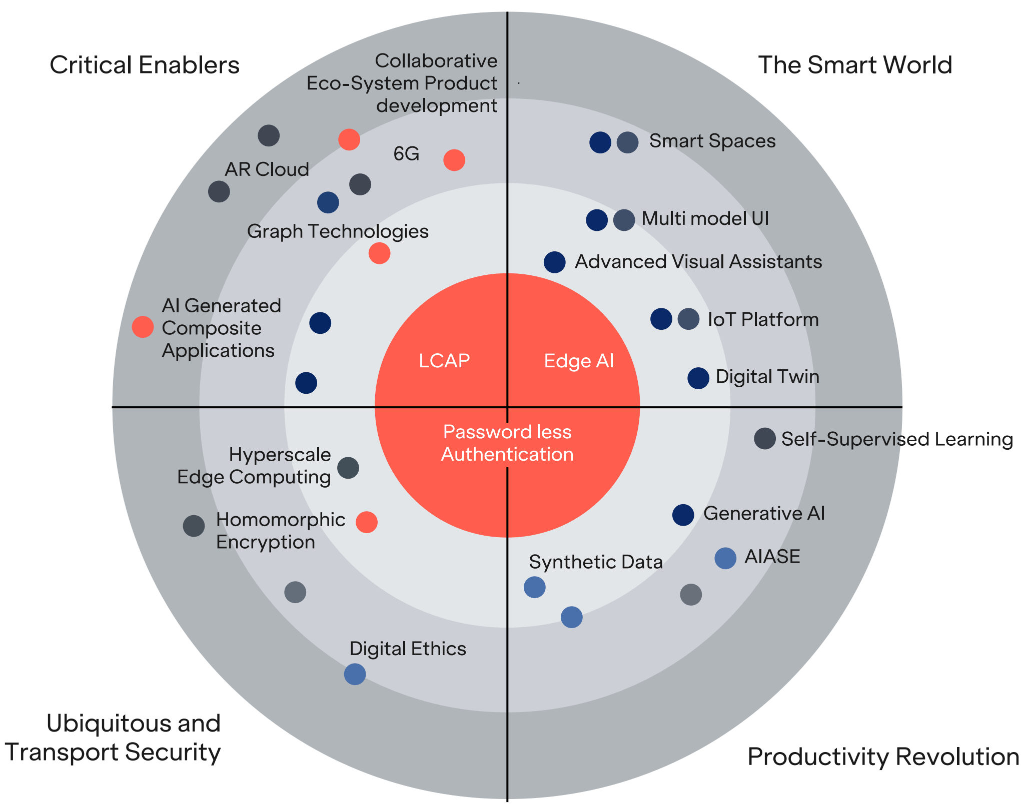


Fig. 1 Emerging Technologies

Within this evolving landscape, technologies such as **Distributed AI, Digital Thread, and Generative AI** are gaining prominence. They are not only enhancing efficiency but also enabling new ways of working and decision-making. As organizations adopt these technologies, they are beginning to move beyond incremental improvements toward more integrated and intelligent systems.

This whitepaper explores these three technologies, their applications, and their potential to shape the future. It also reflects how their adoption is enabling organizations to rethink existing models and, increasingly, **outperform traditional ways of operating.**

Futuristic Techniques

Among such new approaches, three fascinating techniques and their applications are highlighted here.

Distributed AI

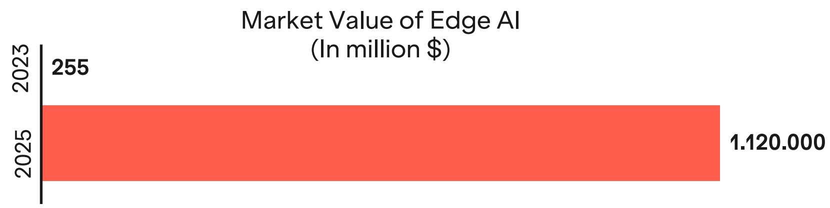
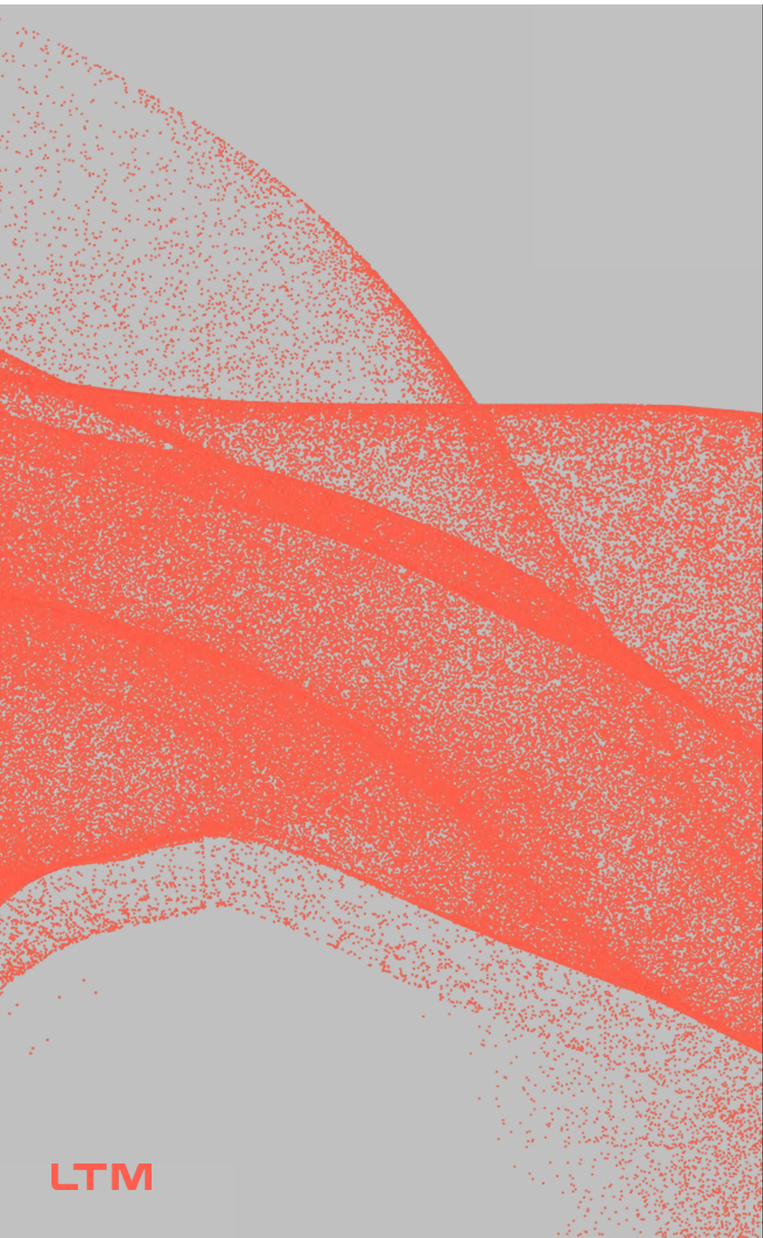


Fig. 2 Value of Distributed AI[iii]

The merger of AI and edge computing has given birth to a new domain known as Edge AI. The value of Distributed AI is shown in Fig. 2. The technology enables the creation of faster insights and computing, greater security, and better control over operations. As a result, it supports performance-heavy AI applications while keeping operational costs manageable. Distributed AI architecture is used when handling time-complex data, performing processes in remote areas requiring local storage, and operating smart devices.



Use Cases of Distributed AI

The adoption of Distributed AI applications can be seen across a range of industries and use cases. Examples include Nest IQ cameras, AWS DeepLens, Apple Neural Engine, Huawei AI processors, Tesla Autopilot, and Intel Myriad X.

- Manufacturing: Precision manufacturing requires high levels of safety and accuracy. With Distributed AI, factory floors become more efficient and reliable. Machine vision enables high-precision quality monitoring, while predictive capabilities help prevent mechanical failures. For instance, Procter & Gamble uses inspection cameras to identify defects by analyzing video data from factory floors.

- Smart hospitals: The adoption of edge computing and AI in healthcare enhances patient care and operational efficiency. Distributed AI supports high-precision thermal screening, inventory management, remote patient monitoring, and disease prediction, while also improving data security.

- Traffic: Distributed AI has significant applications in transportation. Aircraft and autonomous ships generate large volumes of data, which, when analyzed in real time, improves safety. It also enables accurate passenger tracking and efficient vehicle allocation.

Distributed AI: Hello Future

The growth of Distributed AI is on a clear upward trajectory. However, this is only the beginning. Several trends are shaping its future.

- Convergence of Distributed AI and IIoT: When it comes to AI adoption, manufacturing industries, especially those leveraging IoT, are leading AI adoption. The integration of IIoT and Distributed AI is expected to expand across use cases such as inspection, preventive maintenance, and predictive analytics.

- Rise in edge data centers: By 2026, more than five million servers are expected to be deployed at the edge. This growth is driven by factors like 5G networks, IoT proliferation, SDN, NFV technologies, and increased demand for AR and VR and video streaming. These developments support lower latency, improved connectivity, and localized data storage.[iii]

As these trends evolve, enterprises are not only scaling AI adoption but also beginning to **Outcreate traditional cloud-dependent operating models.**

Recent Updates on Distributed AI

On May 17, 2025, a Florida-based AI and analytics platform company launched EdgeAI as healthcare's first operationally embedded AI with explainability. EdgeAI exposes the internal mechanics of machine learning and deep learning systems in human-understandable terms. Trust in AI predictions is essential for adoption, and this transparency supports wider acceptance.[iv]

One of its solutions, EdgeHuddle, enhances healthcare operations.

- Problem: Huddles are essential in healthcare systems, but significant time is spent manually searching and collecting data for huddle reports. Nurse managers and others spend excessive time each week collecting data, yet reporting remains untimely and inconsistent across units, service lines, and departments. At best what you end up with is a dashboard of dated statistics.

- Solution: EdgeHuddle digitizes the huddle process by curating necessary data from the unit, the facility, and the system, in real-time. EdgeHuddle technology allows hospitals to synchronize the flow of information between all layers and tiers of the health system. Plus, it also creates sure system-wide situational awareness from board-to-bedside.

- Technology: Built on Edgility's Cognitive Platform, EdgeHuddle enhances team and system communication by creating a fractal-rollup visual management board. Adding levers-or-action to the huddle turns the huddle into a powerful workforce tool. For instance, EdgeHuddle has transformed the "SafetyHuddle" by curating information from EMRs and other sources, thereby negating the need for manual data. Edgility's Safety Huddle module effectively decants low-value work from high-value nurses and elevates them to identify and execute the 'levers of action'.[v]

Value of Edge AI

Rising demand for Distributed AI processors in electronic products is fueling the global Distributed AI processor market growth. The global Distributed AI processor market is expected to reach $9,566.30 million by 2030, growing at a CAGR of 16.0% from 2025 to 2030.[vi]

Top Players of the Distributed AI Processor Market

Key players of the global Distributed AI processor market are Intel Corporation, Alphabet Inc., Qualcomm Technologies, Inc., Intel Corporation, Apple Inc., Mythic Ltd., Arm Limited, NVIDIA Corporation, HiSilicon (Shanghai) Technologies CO LIMITED., Advanced Micro Devices, Inc., Samsung Electronics Co., Ltd., and others.

Digital Thread

Today, applications of Digital Thread are widely used across many industries. According to Gartner's survey, 75% of interviewed organizations that already work with IoT use Digital Thread applications. Only 13% of respondents claim to already use Digital Threads, meanwhile, 62% are either in the process of establishing the technology or plan to do so in the next year.[xi]

The digital replica is created with digital drawings, plans, and IoT sensors. The plans and drawings are the foundation of the physical item in a virtual space. Sensors then collect data from that thing and sync it with the digital model to create a real-time replica. The concept, introduced by Michael Grieves, has evolved significantly, with early applications seen in NASA missions.[xii]

Moreover, Digital Thread technology is expanding rapidly and according to a study from Deloitte, the global market for Digital Threads is expected to grow with 38% CAGR (see appendix) and reach $16 billion by 2023, with the proliferation of IoT technology accelerating this growth. All in all, Digital Threads are changing the way work is done in different industries with varying business applications.[xiii]

Digital Threads Technologies

Digital Thread integrates IoT, Extended Reality (XR), cloud computing, and AI to create real-time digital representations and actionable insights.[xii]

Digital Thread Use Cases by Industry

- Healthcare: Digital Thread in healthcare helps medical practitioners virtualize patient experience to optimize care, cost, and performance.

- Aerospace: Before Digital Threads, physical twins were used in aerospace engineering. An example is the Apollo 13 program in the 1970s, where NASA scientists on earth were able to simulate the condition of the ship and find answers when critical issues arose. Later in 2002, the Digital Thread concept was introduced by John Vickers from NASA.

  Today, the importance of Digital Threads in the aerospace industry is widely recognized, with 75% of air force executives expressing their confidence in this technology, according to a survey report by Business Wire.

UK Digital Thread Market Share, By End of 2026

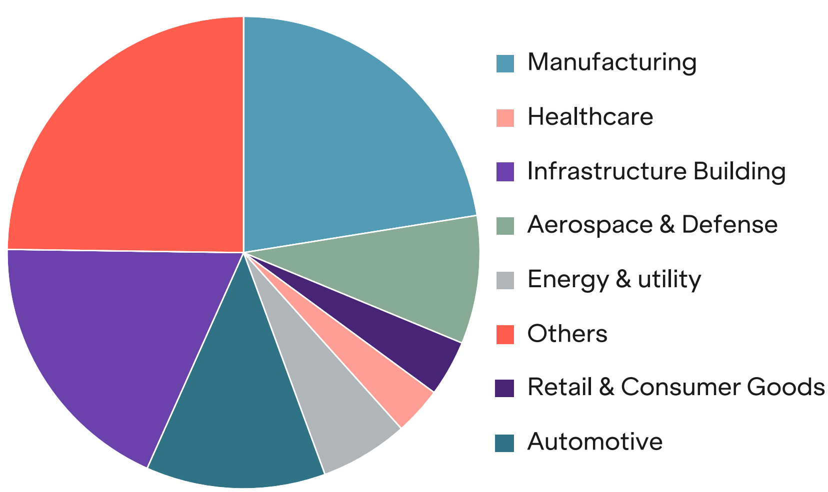


Fig. 3 Use Cases of Digital Thread[x]

Organizations Using Digital Threads

- Rolls-Royce improves jet engine efficiency: Multinational aerospace and defense company Rolls-Royce has deployed Digital Thread technology to monitor the engines it produces. The company can monitor how each engine flies, the conditions in which it is flying, and how the pilot uses it. Rolls-Royce uses Digital Thread to offer service plans tailored to specific engines.

- Mars optimizes its supply chain: Confectionery, pet care, and food company Mars has created a Digital Thread of its manufacturing supply chain to support its businesses. The company is using the technology to improve capacity and process controls, including boosting the uptime of machines via predictive maintenance and reducing waste associated with machines packaging inconsistent product quantities.

- TIAA reduces client service complexity: The Teachers Insurance and Annuity Association of America–College Retirement Equities Fund (TIAA) is using a Digital Thread to reduce the complexity of onboarding new institutional clients. TIAA's twin uses product metadata, operational flows, overlapping interdependencies, and business rules to validate plan operators' service plan selections.

- Bayer Crop Science reshapes strategy with virtual factories: Bayer Crop Science has created "virtual factories" for each of its nine corn seed manufacturing sites in North America. The virtual factories are dynamic digital representations of equipment, process and product flow characteristics, bill of materials, and operating rules for each site. In addition to providing a real-time view of operations, the virtual factories allow Bayer to perform "what-if" analyses that the company uses to analyze new strategies, make capital purchase decisions, create long-range business plans, and improve processes.[ix]

  These implementations illustrate a broader shift. Organizations are not just improving visibility or efficiency within existing frameworks, they are redefining how products are designed, delivered, and serviced. In doing so, they move beyond traditional product-centric models toward continuous, data-driven value creation. This is where Digital Thread enables enterprises not simply to compete within the market, but to Outcreate it, by replacing static, linear operating models with dynamic, continuously evolving systems.

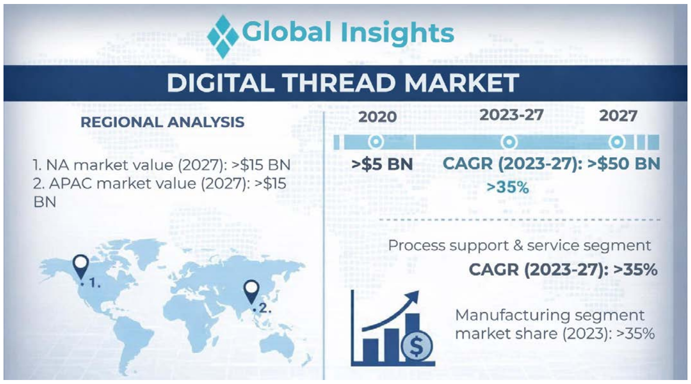
Digital Thread Companies

Many organizations are building their own Digital Threads, but there are also several established platform vendors. Some of the more popular offerings include aPriori Digital Manufacturing Simulation Software, Autodesk Digital Thread, Ayla IoT Platform, AWS IoT, Enterprise Process Center (EPC), Oracle IoT Production Monitoring Cloud, Predix Platform, and SAP Leonardo Internet of Things.

As these platforms continue to evolve, they are enabling organizations not just to adopt Digital Thread capabilities, but to embed them at scale, shifting from isolated implementations to enterprise-wide transformation.

Digital Thread Market

The Digital Thread market is growing at a rapid pace. Research firm Markets and Markets reports that the global Digital Thread market was valued at $3.1 billion in 2020 and is expected to reach $63.5 billion by 2027. It considers Digital Thread a key component of the fourth industrial revolution, or Industry 4.0.[ix]



Global Market Insights estimates that the market, valued at $3 billion in 2018, is expected to grow to $20 billion between 2019 and 2025.[x]

This growth reflects a structural shift in how enterprises operate. As Digital Thread becomes foundational, organizations are moving beyond traditional, stage-based operations toward continuous, data-driven ecosystems, positioning themselves to Outcreate the market by redefining how value is designed, delivered, and sustained.

Generative AI

Generative AI is a subfield of machine learning that focuses on the generation of new data. It differs from other subfields, such as reinforcement learning or deep learning, which are primarily concerned with learning from existing data. Generative AI algorithms are used to create new data, including images, text, and audio.

It has emerged as a significant area of innovation, with applications such as DeepFake highlighting both its capabilities and its challenges. Generative AI leverages AI and machine learning algorithms but also raises concerns related to data privacy and potential misuse in fraudulent or criminal activities.

Various Generative AI Techniques

- Generative Adversarial Networks (GANs): GANs consist of two neural networks, a generator and a discriminator that compete to reach equilibrium.

  1. The generator creates new data resembling the source data
  2. The discriminator evaluates and differentiates between real and generated data

- Transformers:

  1. Transformers, such as GPT-3, LaMDA (see Appendix), and Wu-Dao, simulate attention mechanisms and assess the importance of different parts of input data.
  2. They are trained on large datasets to understand language or images, perform classification tasks, and generate new outputs.

- Variational Autoencoders:

  1. The encoder compresses input data into a lower-dimensional representation.
  2. The decoder reconstructs the original data from this compressed form. When properly trained, VAEs effectively capture the underlying data distribution.[xiii]

Importance

- Generative AI is important for several reasons. First, it enables the creation of new data that does not yet exist, which is valuable for research and model training.
- Second, it improves existing algorithms by generating training datasets and enhancing model performance.
- Third, it represents a form of automated machine learning, where systems can designs and improve other systems. The implications extend far beyond incremental improvement, opening up new possibilities for innovation and scalability.[xiv]

Industries Benefitting from Generative AI

The image recognition industry stands to benefit greatly from generative AI. By creating more realistic images, it improves the accuracy of recognition systems and enables applications such as automatic photo editing and realistic 3D rendering.

The text generation industry also benefits, as generative AI can create more accurate and contextually relevant content. This enhances chatbots, machine translation systems, and search engines.

Last but not least, the gaming industry is another major beneficiary. Generative AI enables the creation of more immersive environments, richer narratives, and enhanced artificial creativity.xiv

Across these industries, generative AI is enabling entirely new ways of creating and delivering value, allowing organizations to outevolve traditional content-driven competitive models.

Generative AI in Banking

Gartner identifies Generative AI as one of the key technology trends gaining traction in banking and investment services in 2025. Banks and investment firms are expected to spend $623 billion on technology products and services, with Generative AI playing a significant role. Banks are applying Generative AI in areas such as fraud detection, trading prediction, and risk factor modeling. The technology learns digital representations from data and generates new outputs that are similar but not identical to the original.

Applications of GANs and natural language generation (NLG) are widely used in fraud detection, synthetic data generation, and predictive modeling. These capabilities enable a higher level of personalization and decision-making.

As adoption increases, financial institutions are moving beyond traditional service delivery models toward more intelligent, adaptive systems, positioning themselves to Outcreate the competitive landscape in digital banking and customer experience.[xv]

Conclusion

From the moment people wake up to the moment they go to sleep, technology plays a continuous role in everyday life. The rapid advancement of Distributed AI, Digital Thread, and Generative AI highlights how deeply technology is shaping the modern world.

These technologies will continue to impact industries across sectors, enabling improved efficiency, better decision-making, and new opportunities for innovation. As data continues to grow, their relevance and influence will only increase.

However, the true impact lies not just in adoption, but in how these technologies are integrated and applied. Organizations that effectively combine them will be better positioned to respond to change and create new value.

In this evolving landscape, success will not come from incremental improvements alone. It will come from the ability to rethink existing models and Outcreate the market, replacing traditional ways of operating with more adaptive, intelligent, and continuously evolving systems.

This shift reflects the essence of Business Creativity: bringing human insight and intelligent systems together to redefine how businesses operate, compete, and grow.

APPENDIX

LaMDA- Language Model for Dialogue Applications [16]

GPT- Generative Pre-trained Transformer

CAGR- Compound Annual Growth Rate

$$CAGR(t_0,t_n)=\left(\frac{V(t_n)}{V(t_0)}\right)^{\frac{1}{t_n-t_0}}-1$$

Where V(t_0) is the initial value, V(t_n) is the end value, and t_n-t_0 is the number of years.

SDN- Software-Defined Networking

NFV- Network Functions Virtualization

AR- Augmented Reality

VR- Virtual Reality

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Anthony is an Agile and transformation leader at LTM with over 16 years of experience delivering large-scale technology and modernization programs across global enterprises. He specializes in Agile delivery, Jira-led transformation, IT service transition, and enterprise governance, with expertise spanning cloud computing, cybersecurity, data governance, and digital transformation.

References

[1] Why Technology Is Important: Overview and Benefits, Sliding Motion, Sliding Motion: https://slidingmotion.com/why-technology-is-important/#Overview_of_Why_Technology_is_Important

[2] 5 Impactful Technologies From the Gartner Emerging Technologies and Trends Impact Radar for 2025, Gartner, 2025: https://www.gartner.com/en/articles/5-impactful-technologies-from-the-gartner-emerging-technologies-and-trends-impact-radar-for-2025

[3] What Is Edge AI?, Appinventiv, Chirag Bhardwaj, Appinventiv, July 7, 2025: https://appinventiv.com/blog/what-is-edge-ai/

[4] Edgility Launches EdgeAI, ITN Online, ITN Online: https://www.itnonline.com/content/edgility-launches-edgeai

[5] Edge Huddle, Edgility Health: https://www.edgilityhealth.com/edge-huddle

[6] Global Edge AI Processor Market Predicted to Hit $9,566.30 Million, Growing at 16.0% CAGR from 2025 to 2030, GlobeNewswire, May 11, 2022: https://www.globenewswire.com/en/news-release/2025/05/11/2440937/0/en/Global-Edge-AI-Processor-Market-Predicted-to-Hit-9-566-30-Million-Growing-at-16-0-CAGR-from-2025-to-2030-225-Pages-Research-Dive.html

[7] 5 Real World Examples of Digital Twins, Palamir, February 28: https://www.palamir.com/news/5-real-world-examples-of-digital-twins

[8] 20 Digital Twin Applications/ Use Cases by Industry, Cem Dilmegani, AIMultiple Research, January 27, 2026: https://research.aimultiple.com/digital-twin-applications/

[9] What Is a Digital Twin? A Real-Time Virtual Representation, Thor Olavsrud, CIO, December 14, 2021: https://www.cio.com/article/301522/what-is-a-digital-twin-a-real-time-virtual-representation.html

[10] Digital Twin Market Size, Share & Forecast, Global Market Insights, November 2025: https://www.gminsights.com/industry-analysis/digital-twin-market

[11] Gartner Survey Reveals Digital Twins Are Entering Mainstream Use, Gartner, February 20, 2019: https://www.gartner.com/en/newsroom/press-releases/2019-02-20-gartner-survey-reveals-digital-twins-are-entering-mai

[12] Use Cases and Applications of Digital Twin, Softengi: https://softengi.com/blog/use-cases-and-applications-of-digital-twin/

[13] Top 125 Generative AI Applications, Cem Dilmegani, AIMultiple Research, April 22, 2026: https://research.aimultiple.com/generative-ai/

[14] 10 Use Cases for Generative AI, Sunvera Software: https://sunverasoftware.com/10-use-cases-for-generative-ai/

[15] Gartner Identifies Three Technology Trends Gaining Traction in 2025, Gartner, May 24, 2022: https://www.gartner.com/en/newsroom/press-releases/2025-05-24-gartner-identifies-three-technology-trends-gaining-tr

[16] 10+ Large Language Model Examples & Benchmark, Cem Dilmegani, AIMultiple Research, February 18, 2026: https://research.aimultiple.com/lamda/