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Automation

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1 High-bandwidth memory (HBM) is an underappreciated investment opportunity in the AI revolution. Essential to AI workloads, HBM chips are sold out for the next two years and manufacturers are investing to increase capacity. *This week, we are making changes in the 13D Automation Index components and remain bullish on the sector.*

For over a decade, we have argued that artificial intelligence will spread to every industry, improving human abilities, fostering creativity, and raising productivity (see reports). The rapid developments and adoption of generative AI (GAI) are a step change in the technology's penetration.

HBM-chip availability is essential for this shift, but the focus on GAI and GPU development has largely eclipsed its appeal to the markets. Jensen referred to HBM chips as a ***"technological miracle."*** HBM chips are designed for high-performance computing. They consist of DRAM (dynamic random-access memory) chips stacked together using advanced 2.5/3D semiconductor-packaging technology to boost performance and efficiency.

HBM-chip capacity is sold out through 2025. The largest producers of HBM chips, **SK Hynix** (000660 KS), **Samsung Electronics** (005930 KS), and **Micron Technology**

(MU), which together control nearly 100% of the global supply, have reported that any new orders will have to wait until 2026 for delivery.

SK Hynix registered a 5x y-o-y increase in HBM3 chip sales last year. HBM chips, including HBM3, make up 50% of Samsung Electronics' semiconductor sales and are expected to exceed 90% by the end of the year. A *Digitimes* study estimated that NVIDIA had paid SK Hynix and Micron between $540 million and $770 million in advance to secure the supply of HBM chips. NVIDIA and Alphabet are expected to account for two-thirds of HBM-chip demand in 2025, followed by Amazon, AMD, and Intel at 10%, 8%, and 5%, respectively.

HBM chips add tremendous value to the output of the AI platforms. These chips facilitate quicker data transfer speeds and lower power consumption than typical DRAM chips found in devices for regular computation. *HBM's competitive advantage is that it quickly feeds massive amounts of data to processors, accelerating model training and real-time decision-making processes.*

The increasing adoption of high-performance computing is pushing beyond the limits of conventional memory capacity and bandwidth requirements, forcing the use of HBM processors.

Consider the following:

- HBM chips solve many shortcomings of conventional memory circuits used for computation.
- HBM-chip technology is advancing rapidly.
- HBM chips are poised to gain market share in the total-memory semiconductor market.
- Memory-chip manufacturers' HBM-production capacity may reduce DRAM availability.
- China is also making significant progress in building domestic capabilities to produce HBM chips.

The 13D Automation Index is positioned to benefit from the global adoption of high-performance computing, which is impossible without HBM chips. Index

components **Cadence Design** (CDNS) and **Synopsys** (SNPS) offer the most comprehensive services in developing HBM chips. **TSMC** (2330 TT), a constituent of the 13D Next-Generation Wireless Index, will also be a primary beneficiary.

This week, we are adjusting the 13D Automation portfolio by removing some laggards and including HBM chip companies. We are removing **Ansys (ANSS)** and **UiPath** (PATH) from the index. We are adding **SK Hynix** (000660 KS) and **Samsung Electronics** (005930 KS).

Two other companies on our watchlist are **Micron Technology** (MU) and **Applied Materials** (AMAT).

2 AI's future is open-source and decentralized. What are the implications? We remain bullish on the 13D Automation Index.

For over a decade, we have argued that artificial intelligence will spread to every industry, improving human abilities, fostering creativity, and raising productivity (see reports). However, big-tech companies currently control most of the core development for large language models (LLMs), given that their deep pockets allow access to high-performance computing and other resources. *Decentralized AI running on distributed ledger and open-source code, is emerging to challenge the big-tech domination of this transformational technology.*

GAI's rapid advancements, flurry of applications, and accelerating adoption have raised concerns because these LLMs are proprietary (i.e., closed source) and limit transparency. Big-tech companies have kept their GAI model training and tuning processes undisclosed. Meta's public release of its LLM has led to a massive development of open-source models. HuggingFace, a platform for sharing open-source models, now offers over 660,000 LLMs.

Centralized GAI LLMs pose significant challenges and risks to developing credible and responsible AI. Big-tech companies have long struggled with

data privacy, but security challenges exist across both open- and closed-source LLMs. These models may reflect biases in the data from which they are trained, influencing the narrative through the information they generate.

Open-source LLMs, while promoting transparency, face hurdles in ensuring high-quality, unbiased training data at a massive scale. The current, already powerful, open-source models can also be fine-tuned relatively easily by bad actors (see *WILTW* April 4, 2024).

The solution: Decentralized AI, also called distributed AI (DAI). This innovative approach refers to systems that build, train, and run LLMs using distributed-ledger technology, such as a blockchain network, rather than being managed by a single centralized body. *Combining distributed-ledger technology and artificial intelligence will increase data security and privacy and enable individuals to better control their data.*

The convergence of blockchain and AI is gaining momentum with increased research and development efforts. According to a *TenSquared Research* report, the blockchain+AI development is consistently increasing among software coders. The statistics demonstrate growing interest. By the end of 2023, there were over 6,900 GitHub repositories, 539,000 pull requests (proposals for code changes to the main program), 1,500 filed patents, and 5,600 research articles.

Generative AI, the most disruptive technology since the invention of the internet, is on the verge of a paradigm shift as regulators become vigilant and the blockchain-technology ecosystem advances to decentralize AI.

Consider the following:

- The DAI tech software and hardware stack comprises multiple layers that combine to produce a powerful and collaborative AI ecosystem.
- DAI aims to democratize artificial intelligence creation and consumption.
- Distributed-ledger technology strengthens trust in AI.
- Blockchain-based DAI infrastructure addresses centralization problems by offering distributed-processing power, storage, and data collection.

- Blockchain networks are reshaping data creation for AI by incentivizing a global network of contributors.
- DAI's compelling use cases are already emerging.
- The 13D Automation Index will benefit from the evolution of DAI, as it will make AI more accessible and trustworthy, increasing its adoption rate. **NVIDIA** (NVDA) is a leader in energy-efficient and high-performance GPUs. Other compelling investment candidates are **TSMC** (2330 TT), **Advanced Micro Devices** (AMD), and **Arm Holdings plc** (ARM).

3 Generative AI is an energy-hungry, unstoppable megatrend intersecting with growing challenges in the quest for sustainable energy security. The megatrend establishes long-term bullish prospects for uranium, clean energy, and grid infrastructure. *How to invest.*

For over a decade, we have argued that artificial intelligence will become mainstream in every business, enhancing human capabilities, spurring innovation, and increasing productivity. The democratization of generative AI (GAI) is a step change in the technology's proliferation.

GAI training and inference consume enormous power (see *WILTW* May 25, 2023). A recent report by SemiAnalysis concluded that AI deployment will account for 90% of the growth in data-center energy demand.

The number of data centers is predicted to increase exponentially. Historically, constructing a data center could take up to two years to complete. However, there have been reports of quicker buildouts lasting only six to 12 months.

Clean energy, including nuclear, is becoming the preferred choice to meet the exponential power demand from GAI data centers. The current grid infrastructure is inadequate to meet the tremendous increase in power demand (see *WILTW* reports). At the COP-28 summit, 130 governments committed to triple the installed renewable energy, and 22 are committed to increasing nuclear-power generation capacity by 3x. **The big-tech companies that run most of the GAI data centers are committed to net-zero carbon footprints.**

Last week, Microsoft signed a groundbreaking $10 billion deal with Brookfield Asset Management (BAM) and Brookfield Renewable (BEP). The deal, which will provide 10.5 GW of clean energy to Microsoft between 2026 and 2030, is almost 8x the size of the second-largest corporate purchase agreement ever signed, highlighting the urgency and growing magnitude.

Last week, data-center developers in North Virginia also requested an incremental power supply equivalent to the output of several nuclear reactors. Dominion, the region's primary electric utility, has connected 94 data centers over the past five years, consuming about four gigawatts of electricity. *Two or three data center campuses now in planning stages could require electricity equivalent to all the data centers Dominion has connected to the grid since 2019.*

Recently, Amazon acquired a data-center campus in Pennsylvania for $650 million, allowing the company to develop up to a 960-megawatt data center powered entirely by an adjacent 2.5 GW nuclear-power plant.

Sam Altman believes in the interconnected evolution of GAI and sustainable energy. He envisions a future where energy is both more economical and more sustainable, resulting in a positive "exponential curve."

Increasingly, nuclear energy and other alternative power sources appeal to companies and governments. However, a structural uranium deficit and the geographic concentration of the clean-energy supply chain make implementation challenging. Additionally, power-grid infrastructure is antiquated and has long been underappreciated by investors. Significant

investments will continue to be made in constructing substantial onshore capacity and procuring raw materials for cleaner electricity sources.

Consider the following:

- Planned U.S. sanctions against importing uranium from Russia will amplify the structural uranium-supply deficit.
- The global reliance on China for critical materials is a supply-chain chokepoint.
- Capacity expansion of critical-minerals mining and refinement outside of Russia or China could be insufficient to meet the demand for green energy.
- Grid infrastructure is a significant limiting factor requiring massive investments.
- The U.S. government is funding infrastructure development, recognizing the need for clean-energy manufacturing and grid updates.

The investment implications are broad and significant. *Beneficiaries include:*

- The 13D Uranium Index will be a significant winner as big-tech companies realize the importance of nuclear energy in meeting data-center demand.
- The 13D Clean Energy Index will emerge as a long-term beneficiary.
- The 13D Automation index will benefit as generative AI adoption continues to accelerate.
- Long-term winners will be the companies that produce cooling solutions to reduce energy consumption in data centers.
- Leaders in providing grid modernization equipment and software will emerge as major winners.

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