

EQUITY  
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# Introducing the BlueStar<sup>®</sup> Big Data & AI Index

Transforming Company Innovations through Big Data

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## Drilling for Digital Oil in the Era of AI

An estimated USD 328.77 million terabytes of data are captured, transmitted, and stored worldwide each day.<sup>1</sup> That is the approximant equivalent to streaming 22 million years of HD video content (with an average bit rate of 4Mbps) or filling more than 650,000 500GB hard drives daily. The generation of such immense volumes of data - whether structured or unstructured, static, or real-time - has necessitated innovation in how they are processed, organized, accessed, and analyzed. More to the point, these data are the lifeblood of numerous applications, including machine learning, and the innovations in the handling of big data have provided the foundation upon which the era of AI is being built. In this whitepaper, we dive into the [BlueStar® Big Data & AI Index \(BDAI\)](#) and explore why data is often referred to as the oil of the 21<sup>st</sup> century.

Big data, as an industry, evolved out of the need to make sense of colossal datasets that traditional data processing tools couldn't handle effectively. The explosion of data generation and harvesting is driven by various factors such as increased digitization, proliferation of cloud and edge computing, artificial intelligence, the surge of Internet of Things (IoT) devices, and more. Today's world is inherently interconnected, and this omnipresent connectivity is a constant source of data inflow.

When harnessed, big data can provide immense value to businesses, governments, and society at large. Business Intelligence (BI) and Artificial Intelligence (AI) are two critical emerging use cases. BI systems transform raw data into meaningful information by discovering correlations and patterns to reveal actionable insights. On the other hand, AI, particularly machine learning, adds a predictive dimension to this process. AI systems can learn from data, identify trends, and make predictions with minimal human intervention.

We can only harness big data, however, through the utilization of technologies that have the capability to analyze extensive datasets with speed and precision far beyond human capabilities. Such technologies are used to forecast customer behavior, optimize supply chains, detect fraud, streamline workflows, and improve healthcare outcomes, all of which boost economic productivity. In essence, big data technologies not only improve efficiency but also serve as the backbone for strategic decision-making, transforming raw data into what is considered the digital oil in our information-driven era.

This paper serves as a primer on the big data industry, taking on topics such as defining big data and identifying the key technologies used in harnessing big data. The paper also demonstrates how the [BlueStar® Big Data & AI Index \(BDAI\)](#) maps publicly traded stocks to those big data technologies and pulls them together into a transparent and rules-based index solution.

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<sup>1</sup> Statista. (2022). Volume of data/information created, captured, copied, and consumed worldwide. Retrieved August 1, 2023, <https://www.statista.com/statistics/871513/worldwide-data-created/>.



## Characteristics and Challenges of Big Data

Big data, being the building block upon which any modern organization thrives, is best described using the “7 V’s”: **Volume, Velocity, Variety, Variability, Veracity, Value, and Visualization.**<sup>2</sup> It is worth mentioning that each of these dimensions brings along both potential benefits and obstacles in working with big data.

<b>Volume</b>	As the amount, as quantified by bytes, of collected data perpetually expands, there is an increasing demand for infrastructure to clean, store, and manage this information.
<b>Velocity</b>	The rate at which data is being generated is accelerating, putting pressure on the network capacity.
<b>Variety</b>	There are many different types of data, both structured and unstructured, including text, images, audio, video, sensory information, and more, contributing to the intricate nature of what we understand as ‘data’.
<b>Variability</b>	Inconsistencies in data over time can be due to the inherent complexity of the data, changes in data sources, or changes in how the data is measured, collected, and processed.
<b>Veracity</b>	Accuracy and reliability of the data emphasize the importance of data quality and the potential challenges posed by irregularities.
<b>Value</b>	The ability to differentiate between data that can add value and data that cannot is an integral part of extracting meaningful information.
<b>Visualization</b>	Depicting the analyzed data in a format that is visually reputable and understandable is key to enabling quick and informed decision-making.

Arguably the most critical challenge that emerges due to these inherent traits of big data is information security. It is estimated that USD 45.7 million U.S. residents were affected by health data breaches in 2021, and USD 34 million in 2020<sup>3</sup>. The sheer magnitude and complexity of data is what makes it difficult to protect data from breaches, unauthorized use, access, disclosure, or disruption. Different security challenges that big data applications encounter include implementing real-time security monitoring, managing the extensive scale of the network, and the lack of robust intrusion detection systems (IDS).

## Industry Drivers

The Seven V’s of big data are challenges that drive the need for the solutions provided by companies included in the [BlueStar® Big Data & AI Index \(BDAI\)](#). This section dives into some of the technologies that provide the capacity for big data sets to be physically stored, what technologies are driving the generation of big data sets, and how ultimately AI and BI are creating demand and consuming big data.

<sup>2</sup> Trigyn Technologies. (2023). The Seven V’s of Big Data Analytics. Retrieved August 1, 2023, <https://tinyurl.com/4ysp3fe7>.

<sup>3</sup> Statista (2022), US Department of Health and Human Services (Office for Civil Rights), Retrieved August 1, 2023, <https://www.statista.com/statistics/798564/number-of-us-residents-affected-by-data-breaches/>.

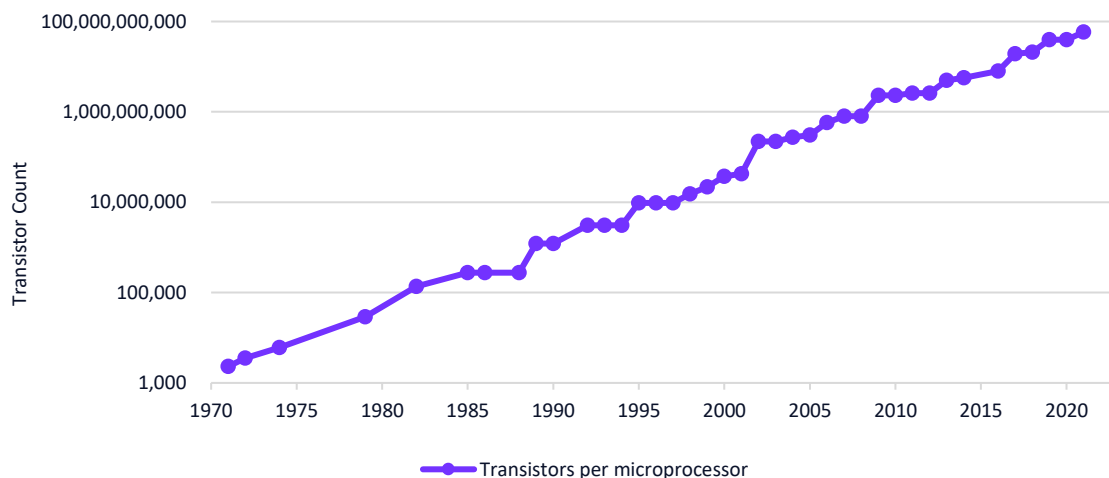
## Enabling Factors

Several contextual factors have compelled industries to adopt big data solutions; these elements can be multifaceted, originating from both external and internal influences, including technological innovation, competitive dynamics, market trends, regulatory standards, and evolving customer expectations.

An example of an external driver that is influenced by technological innovation and market trends is the decline in **data storage costs**. This can be explained by the exponential increase in computing power and storage capabilities, known as Moore’s Law, a principle that states that the number of transistors on a processor will double approximately every two years, as depicted on a logarithmic scale in **Exhibit 1**. Competition among cloud storage providers has also worked to push data storage costs lower. Overall, data storage capabilities continue to play a crucial role in the proliferation and expansion of our digital world.

Although Moore’s Law has held true for the past 50+ years, there is doubt whether the projection can be sustained, based on the physical limitations of transistors approaching the size of a single atom. Even still, at the 2022 IEEE International Electron Devices Meeting (IEDM), Intel claimed to be on track to reach a trillion transistors on a package in the next decade, due to recent research breakthroughs in 3D packaging technology and 2D transistor scaling, including materials the thickness of 3 atoms.<sup>4</sup> For reference, the most powerful GPUs in 2023 have up to USD 146 billion transistors and are 5 nanometers in size, such as the AMD MI300.<sup>5</sup>

**Exhibit 1<sup>6</sup>: Number of Transistors Per Microprocessor**



Source: Data as of 2021. Karl Rupp, Microprocessor Trend Data.

<sup>4</sup> Intel. (2022). Moore's law paves the way for a trillion transistors by 2030. Retrieved August 1, 2023, <https://tinyurl.com/y296p62e>.

<sup>5</sup> TechPowerUp. (2023). Radeon Instinct MI300. Retrieved August 1, 2023, <https://www.techpowerup.com/gpu-specs/radeon-instinct-mi300.c4019>.

<sup>6</sup> Rupp, K. (2022). Microprocessor Trend Data [Source code]. GitHub. <https://github.com/karlrupp/microprocessor-trend-data>.

Object Storage is a data storage architecture that manages data as objects, unlike traditional file or block storage which manages data as a file hierarchy. This cutting-edge innovation provides unstructured data with a unique identifier, allowing it to be retrieved without knowledge of the physical location. As big data continues to grow both in volume and complexity, object-based storage has proven to be a game-changer. Its advantages in scalability, accessibility, and efficiency make it an ideal solution for managing, as it enhances data analysis capabilities and improves the inherent tedious nature of working with large data sets. This innovation in database technology thus stands as a major enabling factor in the industry, driving forward the potential for more sophisticated data usage and analytics.

Quantum computing, an additional enabling driver of data storage capabilities, holds the capacity to significantly disrupt the landscape of the traditional computing industry. Although the field is still in the experimental stages, the potential to leverage quantum mechanics will enable significantly stronger processing speeds, which can address several of the largest challenges in data. Quantum databases are an emerging concept that aims to harness the power of quantum computing for storing and retrieving data. In the long term, quantum computing techniques could redefine how we approach data, bringing new techniques to the processing, storage, and analysis of data.

Notably, quantum computing is projected to introduce significant advancements and risks in the fields of cryptography and data protection. The implication is that traditional encryption techniques, such as Rivest-Shamir-Adleman (RSA), Diffie-Hellman (DH), and Elliptic Curve Cryptography (ECC), will be rendered obsolete superior processing power is introduced. Although this does expose current cybersecurity systems to potential cyber threats, the expectation is that the high barriers to entry in quantum computing will ensure the technology is primarily accessible to those inclined towards safeguarding data rather than exploiting it.

## Rise in Demand for Data

The data industry's growth is revolutionizing sectors like the **Internet of Things (IoT)**, **Artificial Intelligence (AI)**, and **Business Intelligence (BI)**, each offering unique use cases. One notable instance within the BI field is the digital advertising transformation. There has recently been a significant surge in worldwide marketing spending on audience data, with expenditures exceeding USD 52.3 billion in 2021, marking a 26.3% hike from the prior year's USD 41.4 billion.<sup>7</sup> Additionally, the U.S. IoT market is predicted to more than double, from USD 142.49 billion in 2022 to almost USD 300 billion by 2028.<sup>8</sup> In the same vein, advancements in AI are creating unprecedented opportunities. This is manifested by the development of deep learning algorithms that can sift through large datasets and extract meaningful insights, hence further propelling the potential growth of the big data industry.

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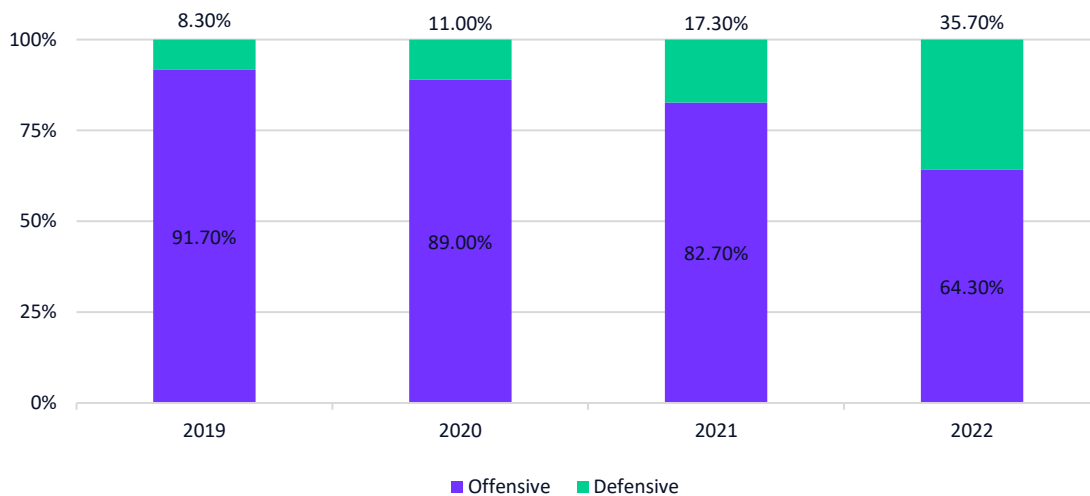
<sup>7</sup> OnAudience.com. (2020). Global Data Market Size 2017-2021. Retrieved August 1, 2023, <http://pressmania.pl/wp-content/uploads/2020/11/Global-Data-Market-Size-2017-2021-OnAudience-Report.pdf>.

<sup>8</sup> Statista. (2023). Internet of Things (IoT) market revenue in the United States from 2017 to 2028. Retrieved August 1, 2023, <https://www.statista.com/forecasts/1334049/internet-of-things-market-revenue-united-states>.

Improvements in data management and processing power have fueled the continuous transformation of our world through Artificial Intelligence technologies. Considering the growing interest in generative AI, we can anticipate the influence of AI to intensify further in the coming years and decades. Over the past two decades, the handwriting, speech, and image recognition capabilities of AI systems have improved rapidly, while reading comprehension and language understanding are relatively recent developments. The latter two capabilities are expected to improve at the same rate at which the recognition capabilities have, with more breakthroughs on the horizon.

As Artificial Intelligence continues to evolve and reshape industries, the way stakeholders invest in Big Data and AI initiatives also shifts. Primarily, these investments can be divided into two aspects: offensive and defensive. Offensive funding pertains to transformation, innovation, and gaining a competitive edge, while defensive elements relate to reducing costs and adhering to regulations. A trend toward investing in big data and AI with a defensive focus has been observed over the past four years, as demonstrated in **Exhibit 2**.<sup>9</sup> This shift could be the effect of companies focusing on cost-efficiency and compliance with ever-evolving regulations in an uncertain economic and legislative environment. It may also be explained by the maturation of the AI market, as companies now must integrate and maintain existing AI systems rather than solely focusing on the development of new ones. Taking a step back, this information substantiates the significance of data and even data on data.

**Exhibit 2: Factors Driving Investment into AI and Big Data from 2019 to 2022**



Source: Data as of 2022. Statista. Factors Driving Investment into AI and Big Data.

<sup>9</sup> Statista. (2022). Factors driving investment into AI and Big Data from 2019 to 2022. Retrieved August 1, 2023, <https://www.statista.com/statistics/1121636/drivers-of-ai-big-data-investment/>.

## Data Generation

In today's digital age, the volume of data generated worldwide is expanding at an unprecedented rate. The exponential growth in the volume of data generated worldwide is largely fueled by advancements in various technological domains, including government regulations, the Internet of Things (IoT), 5G technology, cloud and edge computing, and social media. Each of these areas contributes uniquely to the increasing data landscape, not only in terms of volume but also the diversity of the data generated.

Government regulations have emerged as another driver of data generation by necessitating organizations to collect, store, and secure large volumes of data. Regulatory requirements, particularly in sectors like finance, healthcare, and telecommunications, demand stringent data retention and protection policies for compliance reporting, audits, and cybersecurity, and to demonstrate adherence to industry standards. The strict data security measures that companies are mandated to implement reflect the risk that data breaches, exposures, and leaks present.

The Internet of Things (IoT), put simply, is a rapidly growing network of interconnected devices that generate and exchange data. These devices, which range from household appliances to industrial sensors, are embedded with technologies such as sensors, software, and other electronics that allow them to collect and transmit data over the Internet. This proliferation of connected devices has led to a significant increase in data generation. Every action taken by these devices, whether it's a smart thermostat adjusting the temperature, a health tracker logging a heartbeat, or a security camera recording movement, generates data that can be analyzed and used to improve performance, efficiency, and user experience.

The advent of 5G technology has not only increased the speed of data transmission but also vastly augmented the volume of data generated. 5G supports a larger number of connected devices compared to its predecessors, and with higher speeds and lower latency, it enables the seamless exchange of data among these devices. This creates opportunities for more real-time applications, such as autonomous vehicles or remote surgery, that generate vast amounts of data. Furthermore, the improved connectivity from 5G expands the reach of digital services and devices to more people and locations, further increasing data generation.

Cloud computing has become a cornerstone of data generation and storage. It provides a platform where vast amounts of data can be stored, processed, and accessed from anywhere in the world. Simultaneously, edge computing pushes some data processing closer to where data is generated, minimizing latency, and facilitating real-time analysis. This interplay between cloud and edge computing has expanded the capacity to generate and handle data. For instance, a manufacturing company can use sensors on their equipment to generate data about machine performance, which is processed on-site (at the edge) for immediate adjustments and sent to the cloud for long-term trend analysis and further insights.

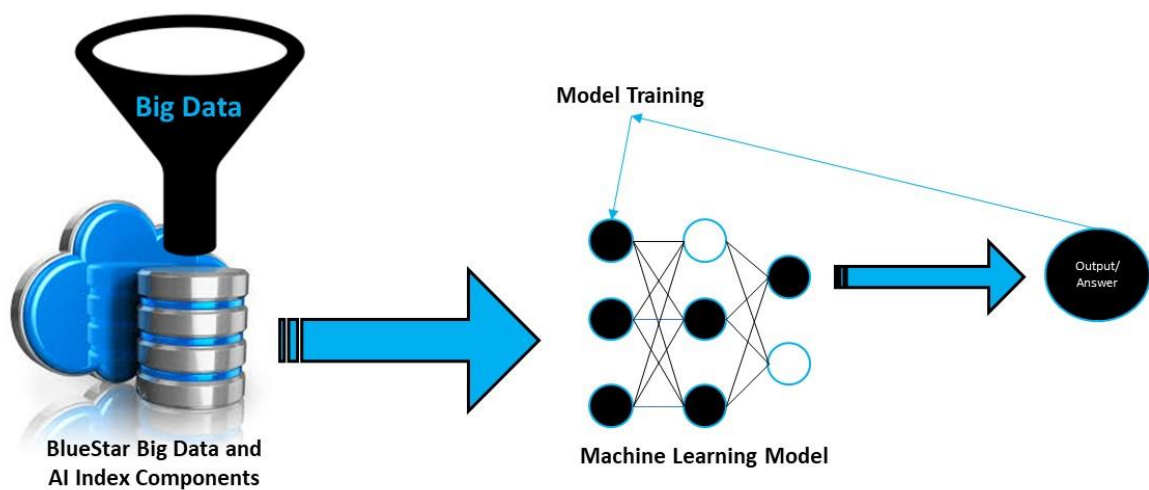
Social media platforms are significant contributors to the global flood of data. Every day, billions of users around the world generate vast amounts of data through their interactions on platforms like Snapchat, Instagram, X (Twitter), and others. Each post, like, share, comment, or even scroll contributes to this data. Social media data includes text, images, videos, and increasingly, more complex data types like augmented reality filters or 360-degree photos. This data is a rich source of insights about consumer behavior, trends, and sentiments, making it invaluable for fields like marketing, journalism, politics, and more.



## Big Data Solutions and the Big Data and AI Index

The **BlueStar® Big Data & AI Index (BDAI)** is comprised of three subthemes, Data Platforms and Database Solutions, Data API Management Solutions, and Data Analytics and Visualization Solutions. Each of these subthemes takes a unique perspective on how businesses handle, integrate, and derive value from their data and facilitate Artificial Intelligence processes. They reflect the foundational pillars that support the comprehensive management of data - from its initial storage and organization to its secure transfer and, ultimately, its transformation into actionable insights.

The purpose of the **BlueStar® Big Data & AI Index (BDAI)** is to provide concentrated exposure to companies operating in one of the critical and foundational steps in the Artificial Intelligence process as depicted below.



### Data Platforms and Database Solutions

In the era of big data and AI, businesses, and organizations require robust data platforms and database solutions to manage and store their vast amounts of data. These platforms help in organizing structured and unstructured data from various sources, making it easily accessible for further analysis. Traditional relational databases, NoSQL databases, and distributed databases each offer unique capabilities to handle different types and volumes of data. California-based company Informatica stands as a prime exemplar of this subtheme, offering robust and comprehensive solutions for managing, storing, and organizing large amounts of diverse data types.

### Data API Management

As data generation increases, so does the need for efficient data sharing and integration. Data API (Application Programming Interface) management solutions facilitate this process by allowing different software applications to communicate with each other. APIs act as gateways, enabling the transfer of data between systems in a controlled manner. This is particularly useful in complex IT ecosystems where different systems may need to access the same data. Data API management solutions also help to secure this data exchange, protect against unauthorized access, and monitor API usage, ensuring smooth and secure data flow across systems.

## Data Analytics and Visualization

The value of data lies in the insights it can provide. Data analytics tools allow businesses to sift through vast amounts of data to identify patterns, trends, and correlations. From basic statistical analysis to complex machine learning models, these tools transform raw data into meaningful information. Coupled with this, data visualization solutions help represent these insights in an easily understandable, graphical format. Visualizations such as charts, graphs, and maps make it easier for decision-makers to grasp complex data trends and patterns, driving informed decisions and strategies. These solutions together make data not just accessible, but also actionable for businesses.

## Company Spotlight

### Splunk Inc.

Splunk Inc. is a multinational corporation based in San Francisco, California, that produces software specifically designed to search, monitor, and analyze machine-generated big data. Founded in 2003, the company has become a leader in its field, providing a range of products that help organizations make sense of their data.

Splunk has also extended its focus beyond big data to incorporate AI and machine learning capabilities. The company's AI-driven solutions are designed to automate operational processes and reduce mean-time-to-repair (MTTR) in IT operations.<sup>10</sup> Maintaining a low MTTR is especially crucial for any organization's continuous operational functionality.

Their flagship product is the Splunk Enterprise software platform. This program collects and indexes data from virtually any source, including logs, events, specific network interactions, call records, and web servers, regardless of its format or origin. In essence, it allows organizations to consolidate their disparate data streams into a single, searchable repository. Once data is inside Splunk's platform, users can run queries, create dashboards, set up alerts, and generate reports to gain insights from their data in real time. This ability to rapidly analyze large volumes of data makes Splunk a valuable tool for IT operations, security, AI development, and business analytics.

### Snowflake Inc.

Snowflake Inc. is a cloud-based data warehousing company that was founded in 2012. The company provides a cloud-based data storage and analytics service, generally termed a "data warehouse-as-a-service". It allows businesses to store and analyze data using cloud-based hardware and software. Snowflake runs on popular cloud hosting platforms like Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft Azure. Snowflake supports a wide range of data types, including structured and semi-structured data, making it highly versatile. It also provides data-sharing capabilities without the need to physically move data, facilitating efficient collaboration between teams and even organizations.

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<sup>10</sup> Splunk. (2022). What is Mean Time to Repair (MTTR). Retrieved August 1, 2023, [https://www.splunk.com/en\\_us/data-insider/what-is-mean-time-to-repair.html](https://www.splunk.com/en_us/data-insider/what-is-mean-time-to-repair.html).

Snowflake provides a robust platform that AI and machine learning (ML) teams can use to store, process, and access large amounts of data quickly, which is crucial in deploying AI and ML models. In recent developments, Snowflake has incorporated three companies specializing in AI technology into its portfolio, namely Neeva, Streamlit, and Applica. Neeva, a search enterprise, utilizes generative AI to facilitate data queries by users. Streamlit functions as a platform enabling developers to experiment with AI applications powered by large language models. Applica, on the other hand, employs deep learning techniques for extracting information and sorting data.<sup>11</sup>

## Holdings and Performance

As of the Q3 2023 review, the BlueStar® Big Data & AI Index (BDAI) was comprised of 17 components and was up 187.89% since inception as shown in **Exhibits 3 and 4**. Companies incorporated in the USA made up about 90% of the index’s weight. **Exhibit 5** depicts the annualized monthly standard deviation on a rolling 1-year basis.

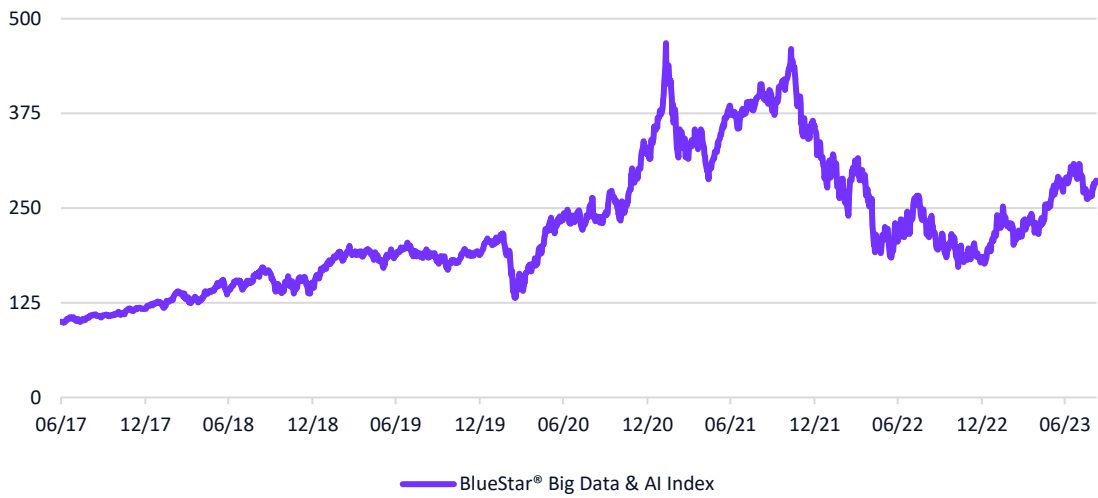
### Exhibit 3<sup>12</sup>: Top 10 Holdings

Name	Country of Inc.	Q3 2023 Weight
ORACLE CORP	UNITED STATES	8.19%
SNOWFLAKE INC	UNITED STATES	8.19%
PALANTIR TECHNOLOGIES INC	UNITED STATES	8.19%
MONGODB INC	UNITED STATES	8.19%
SPLUNK INC	UNITED STATES	8.19%
ELASTIC NV	NETHERLANDS	8.19%
CONFLUENT INC-CLASS A	UNITED STATES	8.19%
NEW RELIC INC	UNITED STATES	8.19%
TERADATA CORP	UNITED STATES	8.19%
MICROSTRATEGY INC-CL A	UNITED STATES	8.19%

<sup>11</sup> Snowflake. (2023). Artificial Intelligence Products. Retrieved August 1, 2023, <https://www.snowflake.com/trending/artificial-intelligence-products>.

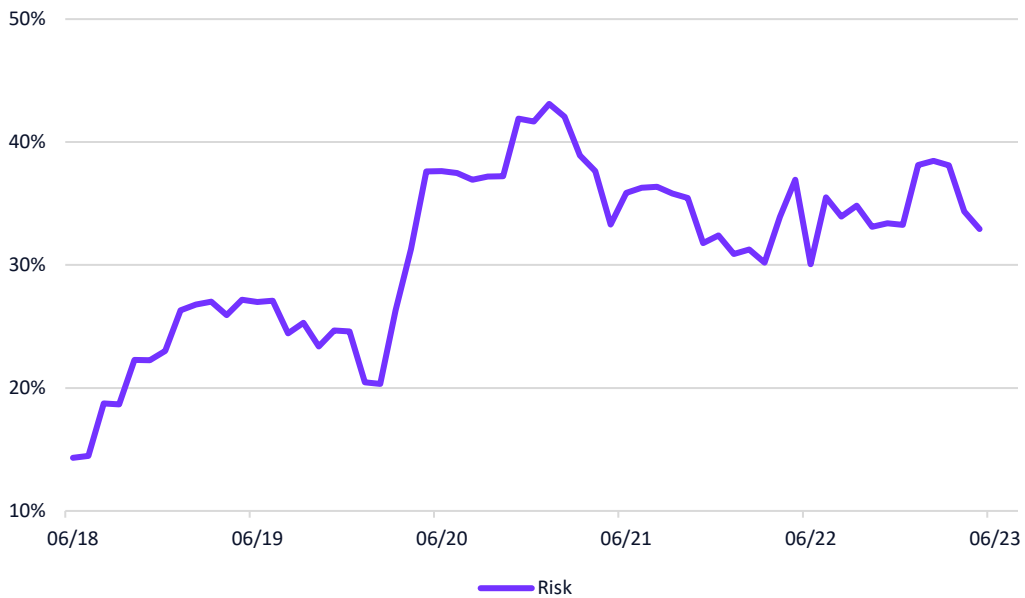
<sup>12</sup> MarketVector. Retrieved Q3 2023, <https://www.marketvector.com/indices/sector/bluestar-big-data-artificial-intelligence/components>.

**Exhibit 4: BlueStar® Big Data & AI Index (BDAITR) Performance from 2017**



Source: MarketVector. Data as of September 8, 2023.

**Exhibit 5: Rolling 1-Year Monthly Volatility Standard Deviation**



Source: MarketVector. Data as of September 8, 2023.



## Conclusion

Though still in its growth stage, the big data and artificial intelligence industry has significantly reshaped our everyday lives on social, economic, and political fronts. The industry is constantly being upended by emerging technological breakthroughs, with OpenAI's ChatGPT being the latest example. This rapidly evolving field continually provides new opportunities and challenges, with the potential to transform the way we interact with the world.

Companies like Snowflake and Splunk are leveraging the emergence of big data and AI as an industry and are investing heavily in R&D and acquisitions to position themselves as leaders in the competitive industry. Today's pioneering companies are not simply taking part in the data industry; they are actively influencing the way businesses adapt to the fast-changing economic environment

The main barrier to entry among the emerging competition is in essence who controls the relevant data. Both the data proprietor and the end-user will assert entitlement to "their" data, and a question of data ethics emerges. This presents an intricate legal and moral landscape, emphasizing the need for comprehensive data governance and privacy regulations to ensure fair and responsible data usage. Nevertheless, due to its multi-faceted applications across various sectors, data is the new oil.

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