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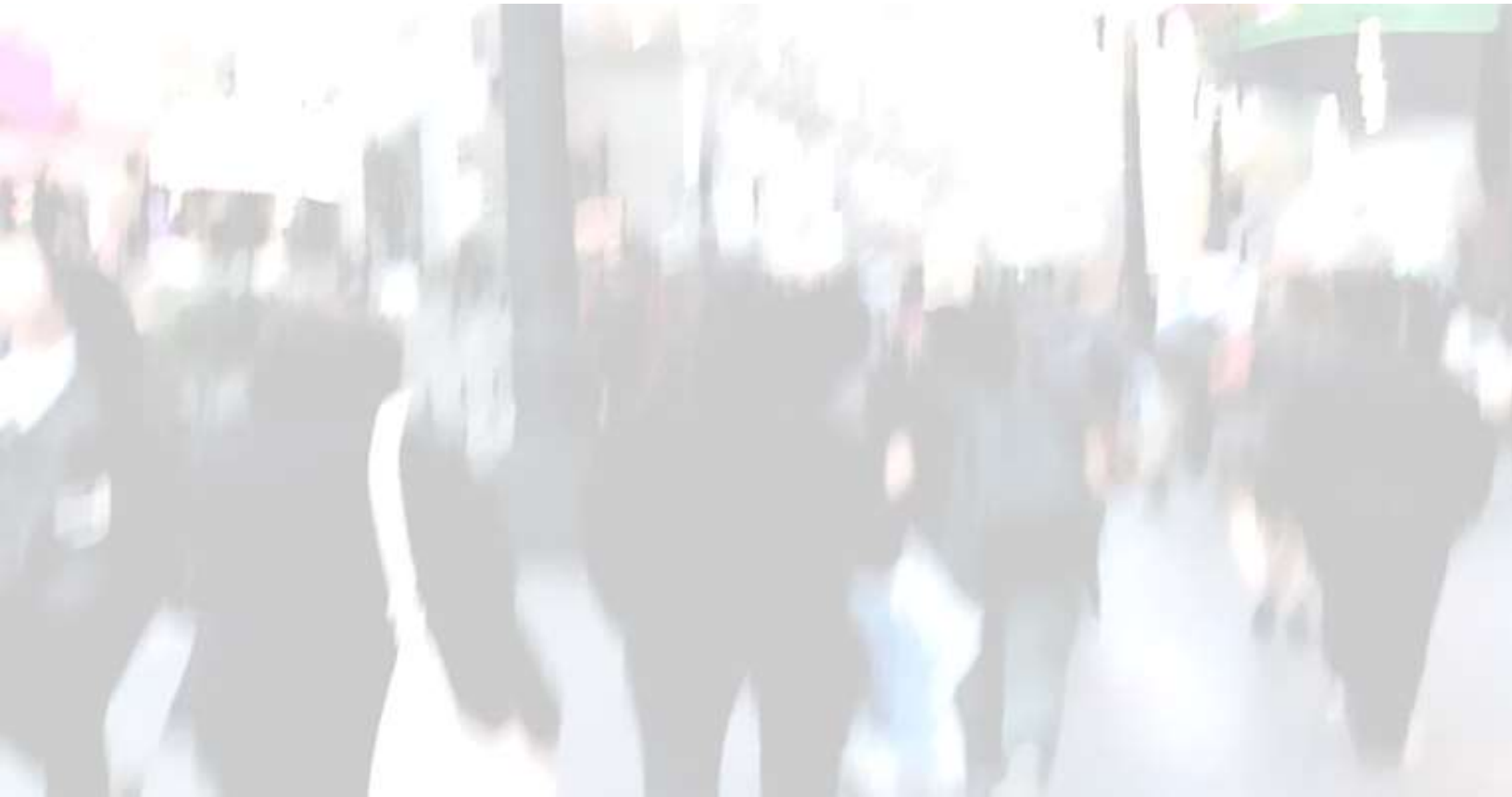
Dresner Advisory Services, LLC

2023 Edition

AI, Data Science, and Machine Learning Market Study

Wisdom of Crowds® Series

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Definitions

Business Intelligence Defined

Business intelligence (BI) is “knowledge gained through the access and analysis of business information.

Business intelligence tools and technologies include query and reporting, OLAP (online analytical processing), data mining and advanced analytics, end-user tools for ad hoc query and analysis, and dashboards for performance monitoring.”

Howard Dresner, *The Performance Management Revolution: Business Results Through Insight and Action* (John Wiley & Sons, 2007).

AI, Data Science, and Machine Learning Defined

“AI, data science, and machine learning” includes statistics, modeling, machine learning, neural networks, and data mining to analyze facts to make predictions about future or otherwise unknown events.

2023 AI, Data Science, and Machine Learning Market Study

Introduction

In 2023, we mark the 16th anniversary of Dresner Advisory Services. We are thankful for the support and encouragement of our clients and related communities. This has allowed us to build a stellar analyst organization and create world-class market research focused exclusively upon data, analytics, business intelligence, performance management, and associated topics.

Last year, in support of our members, we published over 3,500 pages of independent and objective primary research across 20 different Flagship and thematic market reports, 50 Research Insights (thought leadership articles), and 55 Vendor Insights reports. As in previous years, we remain committed to creating the most in-depth and relevant research available for these domains.

With the emergence of generative AI and applications like ChatGPT, there has never been more interest in AI, data science, and Machine Learning. As a result, across all the thematic reports that we publish during the year, this report stands out as having among the strongest and growing interest within our base of readership.

To address the changing markets and demand for these technologies, we added two new sections: generative AI, and AI / DS / ML use cases.

We hope you enjoy this report!

Best,



Howard Dresner
Chief Research Officer
Dresner Advisory Services

2023 AI, Data Science, and Machine Learning Market Study

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Benefits of the Study

The Dresner Advisory Services AI, Data Science, and Machine Learning Market Study provides a wealth of information and analysis, offering value to both consumers and producers of business intelligence technology and services.

Consumer Guide

As an objective source of industry research, consumers use the Dresner Advisory Services AI, Data Science, and Machine Learning Market Study to understand how their peers leverage and invest in business intelligence and related technologies.

Using relevant criteria to evaluate vendors and products, users glean key insights into software supplier performance, enabling:

- Comparisons of current vendor performance to industry norms
- Identification and selection of new vendors

Supplier Tool

Vendor Licensees use the Dresner Advisory Services AI, Data Science, and Machine Learning Market Study in several important ways. For example:

External Awareness

- Build awareness for the business intelligence market and supplier brand, citing Dresner Advisory Services AI, Data Science, and Machine Learning Market Study trends and vendor performance
- Create lead and demand generation for supplier offerings through association with the Dresner Advisory Services AI, Data Science, and Machine Learning Market Study findings, webinars, etc.

Internal Planning

- Refine internal product plans and align with market priorities and realities as identified in the Dresner Advisory Services AI, Data Science, and Machine Learning Market Study
- Better understand customer priorities, concerns, and issues
- Identify competitive pressures and opportunities

2023 AI, Data Science, and Machine Learning Market Study

About Howard Dresner and Dresner Advisory Services

The Dresner Advisory Services AI, Data Science, and Machine Learning Market Study was conceived, designed, and executed by Dresner Advisory Services, LLC—an independent advisory firm—and Howard Dresner, its Founder and Chief Research Officer.

Howard Dresner is one of the foremost thought leaders in business intelligence and performance management, having coined the term “Business Intelligence” in 1989. He



has published two books on the subject, *The Performance Management Revolution – Business Results through Insight and Action* (John Wiley & Sons, Nov. 2007) and *Profiles in Performance – Business Intelligence Journeys and the Roadmap for Change* (John Wiley & Sons, Nov. 2009). He lectures at forums around the world and is often cited by the business and trade press.

Prior to Dresner Advisory Services, Howard served as chief strategy officer at Hyperion Solutions and was a research fellow at Gartner, where he led its business intelligence research practice for 13 years.

Howard has conducted and directed numerous in-depth primary research studies over the past three decades and is an expert in analyzing these markets.

Through the Wisdom of Crowds[®] Business Intelligence market research reports, we engage with a global community to redefine how research is created and shared. Other research reports include:

- Wisdom of Crowds[®] Flagship BI Market Study
- Data Engineering
- Data Catalog
- Embedded BI
- Master Data Management (MDM)
- ModelOps

You can find more information about Dresner Advisory Services at www.dresneradvisory.com.

About Jim Ericson

Jim Ericson is Vice President and Distinguished Analyst with Dresner Advisory Services.

Jim has served as a consultant and journalist who studies end-user management practices and industry trending in the data and information management fields.

From 2004 to 2013 he was the editorial director at *Information Management* magazine (formerly *DM Review*), where he created architectures for user and industry coverage for hundreds of contributors across the breadth of the data and information management industry.



As lead writer, he interviewed and profiled more than 100 CIOs, CTOs, and program directors in a program called “25 Top Information Managers.” His related feature articles earned ASBPE national bronze and multiple Mid-Atlantic region gold and silver awards for Technical Article and for Case History feature writing.

A panelist, interviewer, blogger, community liaison, conference co-chair, and speaker in the data-management community, he also sponsored and co-hosted a weekly podcast in continuous production for more than five years.

Jim’s earlier background as senior morning news producer at NBC/Mutual Radio Networks and as managing editor of MSNBC’s first Washington, D.C. online news bureau cemented his understanding of fact-finding, topical reporting, and serving broad audiences.

The Dresner Team

About Elizabeth Espinoza

Elizabeth is Research Director at Dresner Advisory and is responsible for the data preparation, analysis, and creation of charts for Dresner Advisory reports.

About Kathleen Goolsby

Kathleen is Senior Editor at Dresner Advisory ensuring the quality and consistency of all research publications.

About Danielle Guinebertiere

Danielle is the Director of Client Services at Dresner Advisory. She supports the ongoing research process through her work with executives at companies included in Dresner market reports.

About Michelle Whitson-Lorenzi

Michelle is Client Services Manager and is responsible for managing software company survey activity and our internal market research data.

Survey Method and Data Collection

As with all our Wisdom of Crowds® market studies, we constructed a survey instrument to collect data and used social media and crowdsourcing techniques to recruit participants.

Data Quality

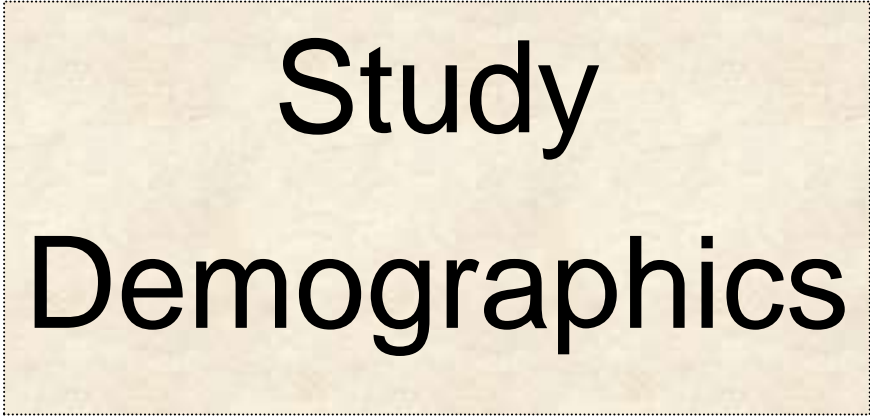
We carefully scrutinized and verified all respondent entries to ensure that only qualified participants were included in the study.

Executive Summary

2023 AI, Data Science, and Machine Learning Market Study

Executive Summary

- *Statistician / data scientist, BI expert, business analyst, and citizen data scientist* are the most likely users of AI, data science, and machine learning (AI / DS / ML). Successful BI organizations employ more users in different roles (fig. 5-11).
- Data science ranks 23rd, and AI ranks 36th of 59 technologies and initiatives we study. AI / DS / ML are between *important* and *very important* to users across industries and roles (fig. 12-18). Industry importance is near an all-time high (fig. 70).
- Current use of AI / DS / ML is very low and mostly experimental; top use cases include *customer segmentation* and *demand forecasting* (fig. 19-26)
- Consideration and actual deployment of AI / DS / ML gains traction over eight years and stands near all-time high criticality above *important*. Success with BI and data literacy correlates with actual AI / DS / ML deployments (fig. 27-33).
- There is increasing longevity of AI / DS / ML programs. *Financial services* and *technology* industry segments have the greatest longevity (fig. 34-38).
- *Outlier detection, range of regression models, and optimization* are the most important analytical features. The *BICC* function, *technology* industry, and very large organizations dominate interest (fig. 39-44). Industry support is very strong (fig. 71).
- *Cleansing and enriching source data, detecting duplicates, set operations,; and complex filtering* are the top AI / DS / ML deployment features. Very large organizations dominate interest (fig. 45-47). Industry support is very strong (fig. 74).
- *Access to advanced analytics, easy iteration, support/guidance, and fast cycle time* are the most important AI / DS / ML usability features. *R&D* and *BICC* interest are highest (fig. 48-52). Industry support is very strong (fig. 75).
- *In-database* and *in-memory* analytics are the most important AI / DS / ML scalability features (fig. 53-56). *BICC, R&D, IT, and operations* respondents are the most interested. Industry support is mixed/strong (fig. 76).
- *Deep learning* and *artificial* are the most important neural networks (fig. 53-59). *Healthcare* and *education* are the most interested. Industry support is incomplete (fig. 73).
- A small minority use generative AI today. Sixty-four percent have *no plans* or *don't know*. Use is highest in *technology* and *business services* (fig. 60-65).
- Open source for AI / DS / ML interest is high but flat. *Azure Data Factory* and *Apache* are most in demand. *Pandas* and *R language* and are top statistical / ML technologies. *Snowflake* and *Amazon S3* are top data sources (fig. 66-69). Industry interest is very high (fig. 78); support for all is strong or selectively strong (fig. 79-81).
- Most industry analytical capabilities are single product proprietary / mixed source (fig. 77).
- AI, data science, and machine learning vendor ratings are on page 99.



Study
Demographics

Study Demographics

Our study includes a cross-section of respondents across geographies, functions, organization sizes, and vertical industries. We believe that, unlike other industry research, this supports a more representative sample that is a better indicator of true market dynamics. We constructed cross-tab analyses using these demographics to identify and illustrate important industry trends.

Geographies

North America (which includes the United States, Canada, and Puerto Rico) represents the largest group in our 2023 study, with about 54 percent of all respondents. EMEA is the second-largest group (26 percent), followed by Asia Pacific (18 percent) and Latin America (3 percent) (fig.1).

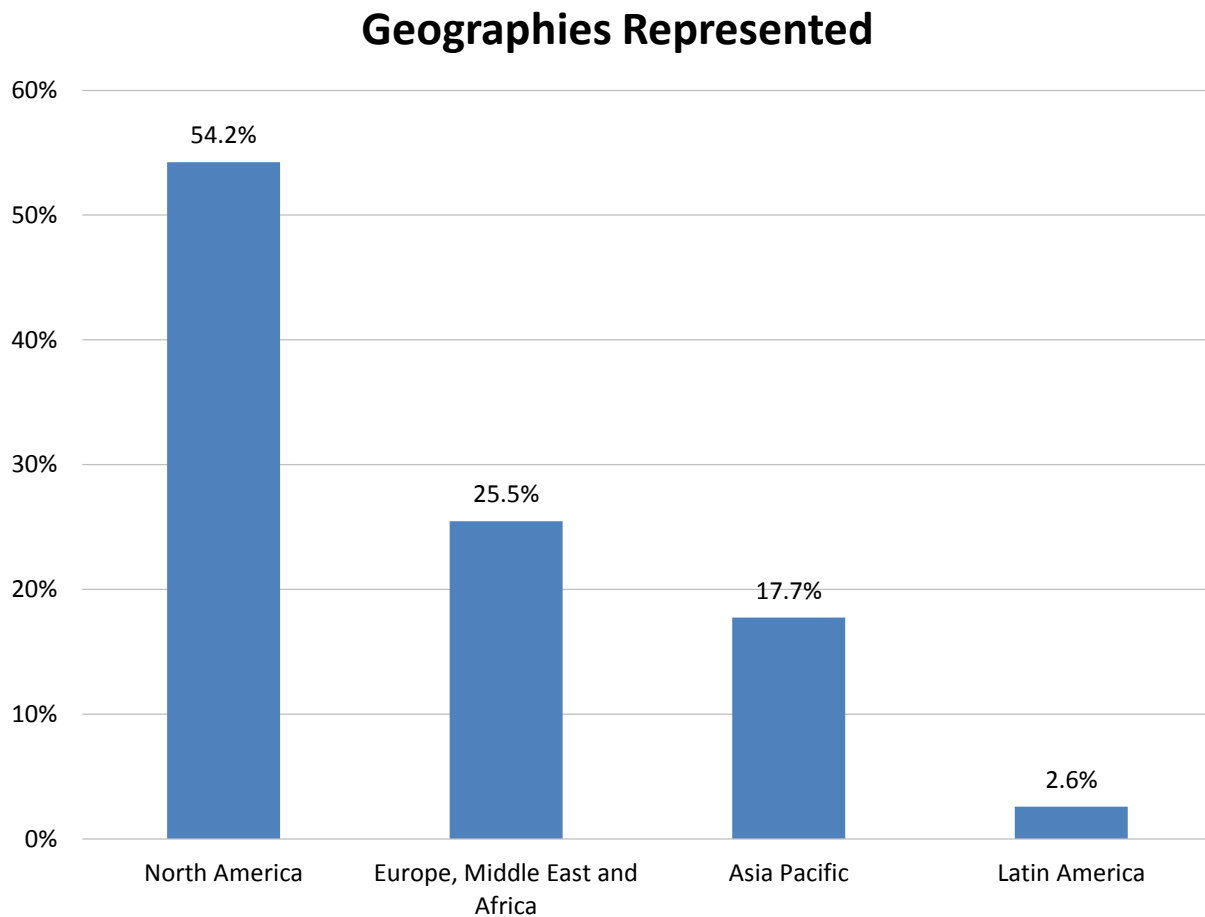


Figure 1 – Geographies represented

Functions

Our 2023 sample includes a cross section of functional roles in respondent organizations. Information technology (32 percent) is the most represented, followed by executive management (19 percent), finance (17 percent), and the BICC (8 percent) (fig. 2).

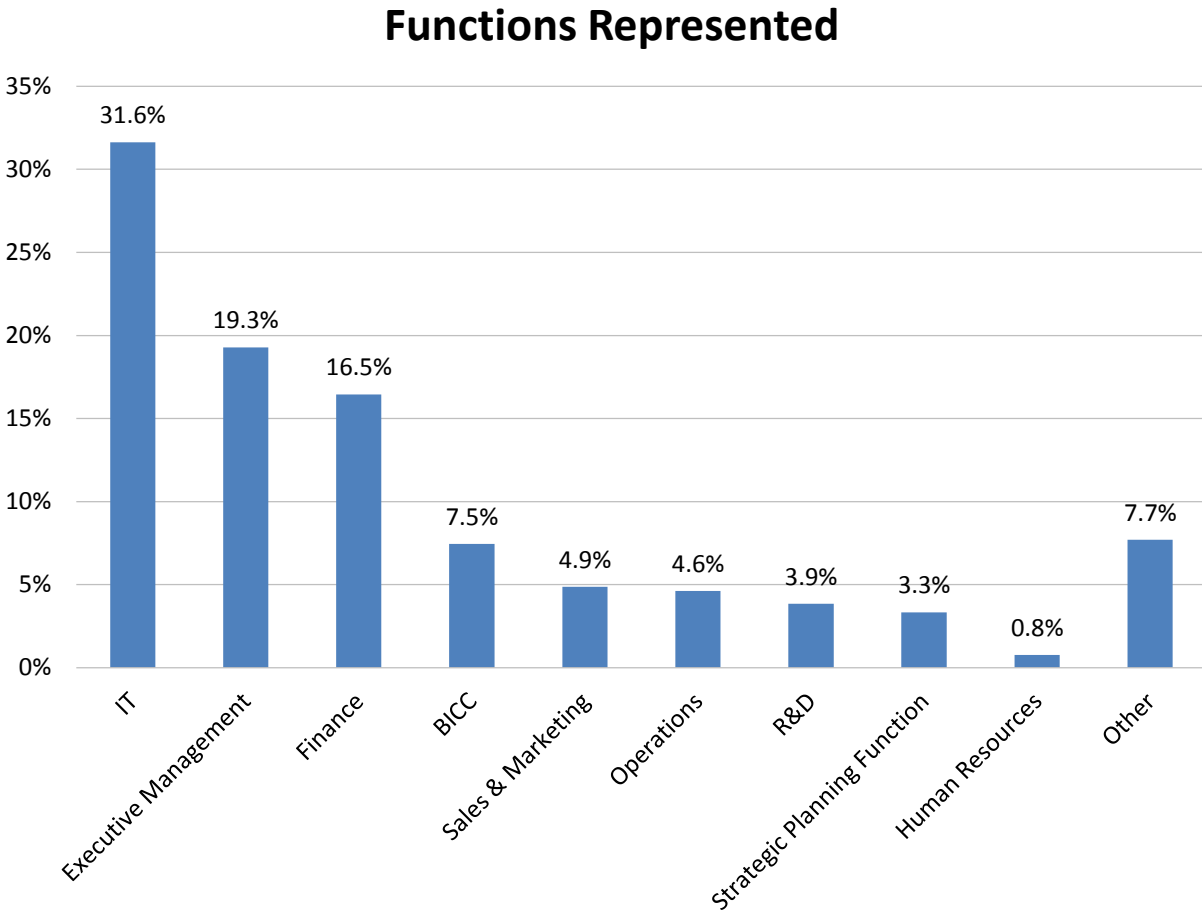


Figure 2 – Functions represented

Vertical Industries

Business Services (26 percent), *technology* (15 percent), *manufacturing* (14 percent), and *financial services* (11 percent) lead industry participation in 2023 (fig. 3). *Healthcare* and *consumer services* are the next most represented.

Vertical Industries Represented

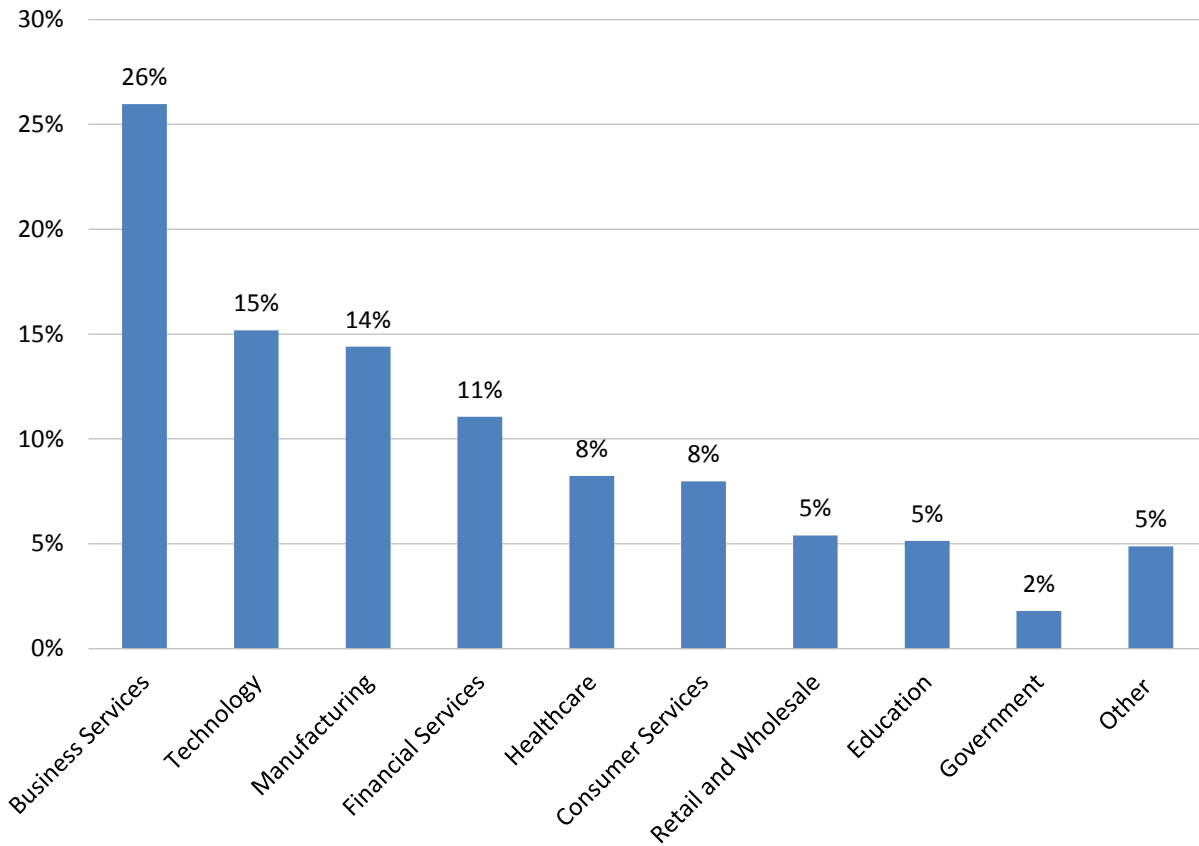


Figure 3 – Vertical industries represented

Organization Sizes

Our 2023 sample includes a mix of small, medium, and large organizations (fig. 4). Small organizations (1-100 employees) and midsize organizations (101-1,000 employees) account for 23 percent and 24 percent of the sample, respectively. Large organizations (>1,000 employees) account for the remaining 53 percent. The chart below further breaks these organizations out by global headcount.

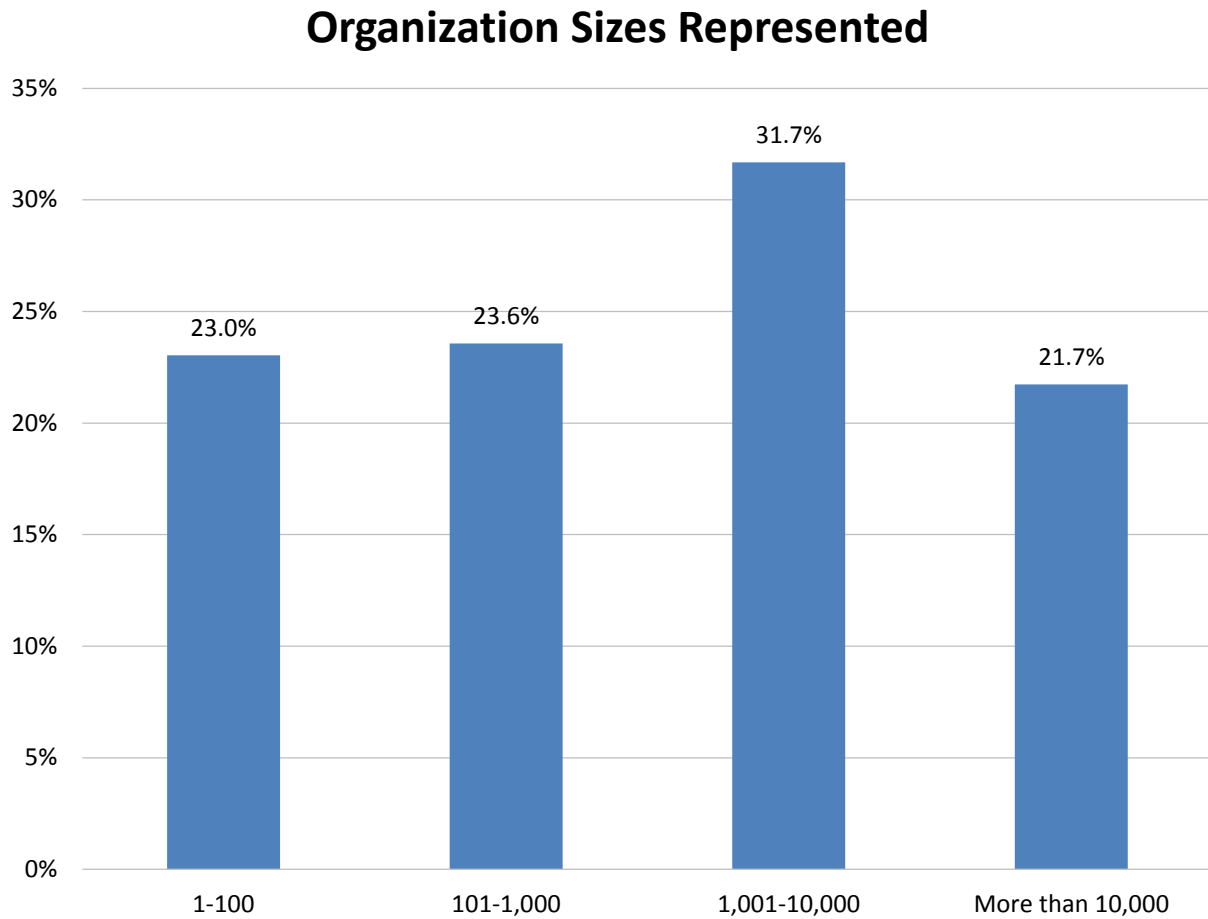


Figure 4 – Organization sizes represented

Analysis and Trends

Analysis: AI, Data Science, and Machine Learning

Users of AI, Data Science, and Machine Learning

Fig. 5 describes the functional users of AI, data science, and machine learning (which we further examine in figs. 6-11). We include *citizen data scientist*, a role that might overlap with business analysts or BI users but generally describes users that can generate models for AI, data science, and machine learning. In 2023, the role of *statistician / data scientist* is the most likely *constant* user of AI, data science, and machine learning (40 percent), and is most likely to be, at minimum, a *constant* or *often* user (70 percent). After *statistician / data scientist*, *BI expert*, *business analyst*, and *citizen data scientist* are the most likely users in descending order. *Financial analyst*, *IT staff*, *marketing analyst*, *executive*, and *third-party consultant* are noticeably less likely users of data science and machine learning in 2023. Nonetheless, even the least likely user groups are about 50 percent or more likely to use AI, data science, and machine learning at least *occasionally*.

AI, Data Science, and Machine Learning Users

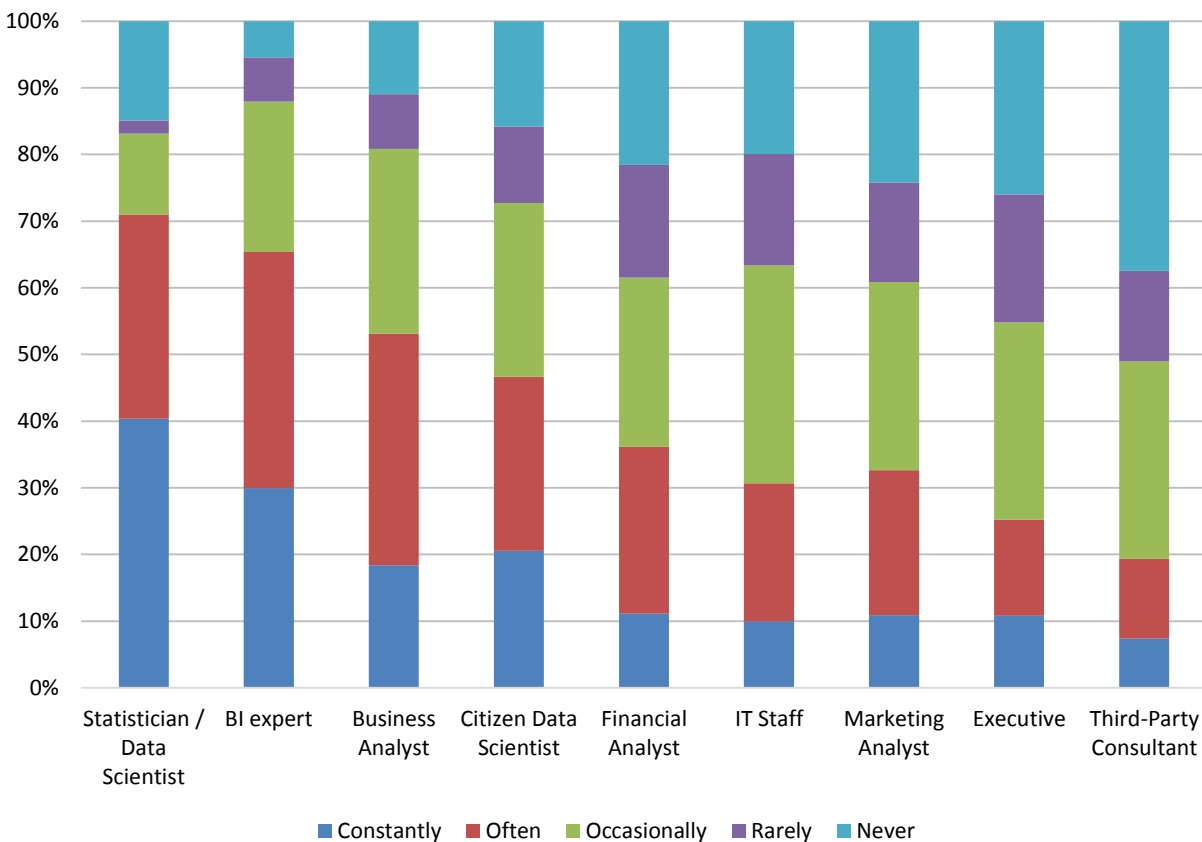


Figure 5 – Data science and machine learning Users

2023 AI, Data Science, and Machine Learning Market Study

Users of AI, Data Science, and Machine Learning Users 2018-2023

Viewed across six years of data collection, all user roles for AI, data science, and machine learning report average to above-average historic levels of use that are at least slightly below all-time high levels (fig. 6). The top user groups, *statistician / data scientist*, and *BI expert*, use the technology at above-average historic levels, as is *IT staff*. *Financial analyst* moved up noticeably year over year in 2023 (from 2.7 to 2.9). All other roles are near average historic levels of usage. At the lowest levels, *third-party consultant* slipped somewhat year over year from a higher weighted-mean ranking in 2022, affirming that AI, data science, and machine learning are largely internal practices.

AI, Data Science, and Machine Learning Users

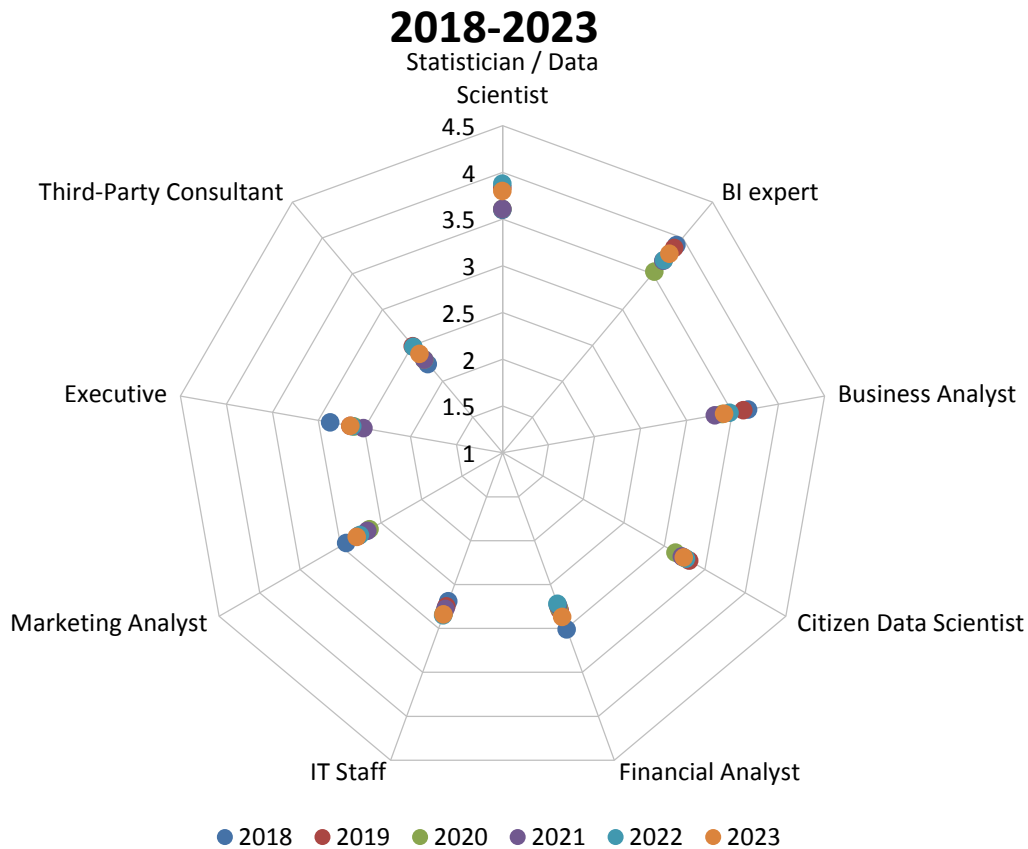


Figure 6 – AI, data science, and machine learning users 2018-2023

2023 AI, Data Science, and Machine Learning Market Study

Users of AI, Data Science, and Machine Learning by Geography

Viewed by geography, all roles with the exception of *BI expert* receive the highest 2023 importance scores from respondents in Asia Pacific (fig. 7). Scores for the top four choices (*statistician / data scientist*, *BI expert*, *business analyst*, and *citizen data scientist*) cluster most across geographies, and all have scores corresponding to at least *important*. Respondents in EMEA post noticeably the lowest scores for lower-ranked choices, particularly for *third-party consultant*, *IT staff*, and *financial analyst*.

AI, Data Science, and Machine Learning Users by Geography

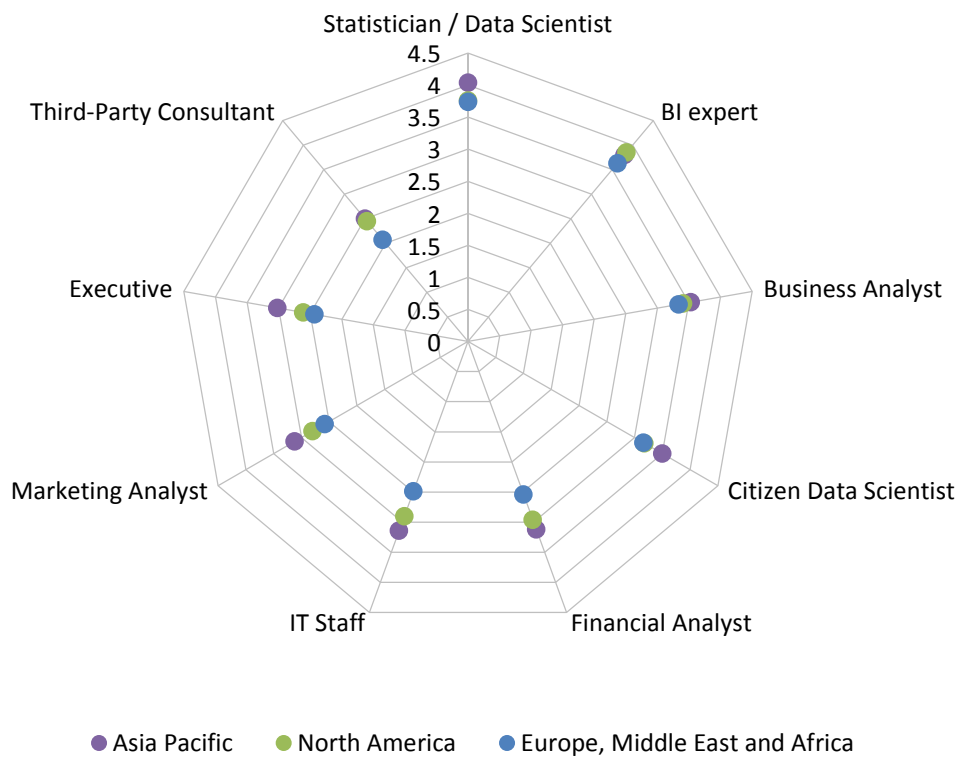


Figure 7 – AI, data science, and machine learning users by geography

2023 AI, Data Science, and Machine Learning Market Study

Users of AI, Data Science, and Machine Learning by Organization Size

The likelihood of various and multiple user roles for AI, data science, and machine learning almost always correlates directly with increasing organization size in 2023 (fig. 8). Roles are distinctly most important in very large organizations (> 10,000 employees), sometimes by a wide margin. This is particularly so in the case of *statistician / data scientist*, *third-party consultant*, and to a lesser extent, *IT staff* and *citizen data scientist*. In very large organizations, *statistician / data scientist* is the only value with the distinction of an importance score of 4.5, approaching the level of *critical* importance. The lone case where small organizations (1-100 employees) post the highest score is in the case of *executive*, where headcount likely dictates the relative ranking.

AI, Data Science, and Machine Learning Users by Organization Size

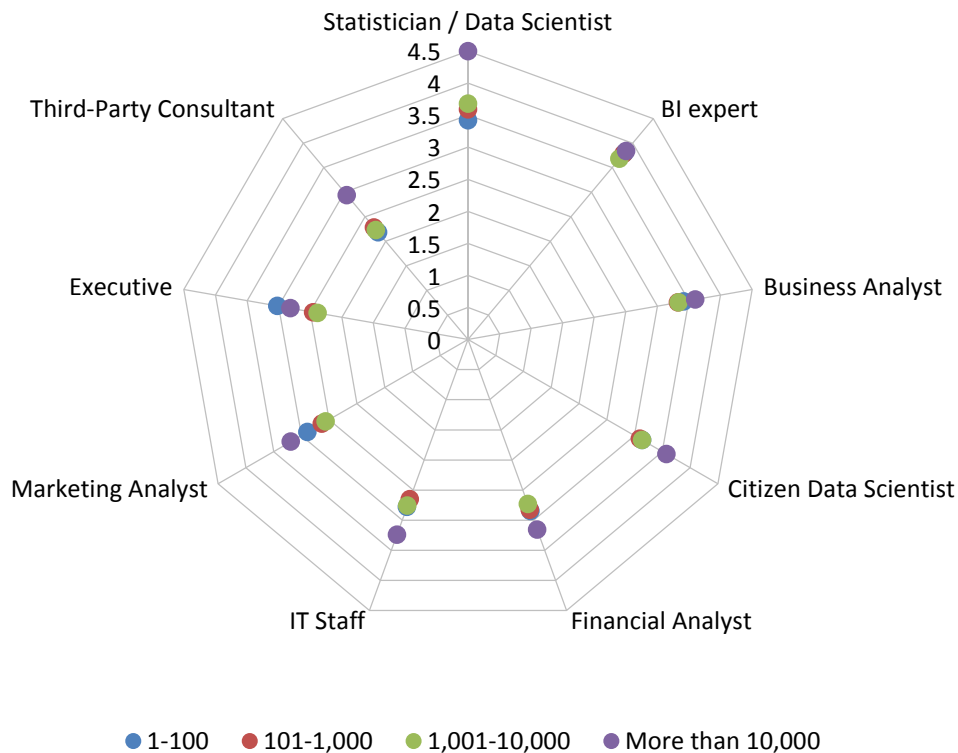


Figure 8 – AI, data science, and machine learning users by organization size

2023 AI, Data Science, and Machine Learning Market Study

Users of AI, Data Science, and Machine Learning by Industry

Taken in sum, multiple industries assign an uneven mix of high to medium and occasionally lower usage by roles for AI, data science, and machine learning in 2023 (fig. 9). This year, the top three user groups, *statistician / data scientist*, *BI expert*, and *business analyst* are, at minimum, *important* to respondents in every industry. Usage frequency also varies by industry by narrow to wide margins. Among many examples, respondents in *financial services* post the greatest interest in *statistician / data scientist*, *citizen data scientist*, and *third-party consultant*. *Retail and wholesale* respondents are narrowly most interested in *BI expert* and *business analyst*. Respondents in *education* most often identify *IT staff* as users, while interest among *healthcare* respondents tends to lag most other industries.

AI, Data Science, and Machine Learning Users by Industry

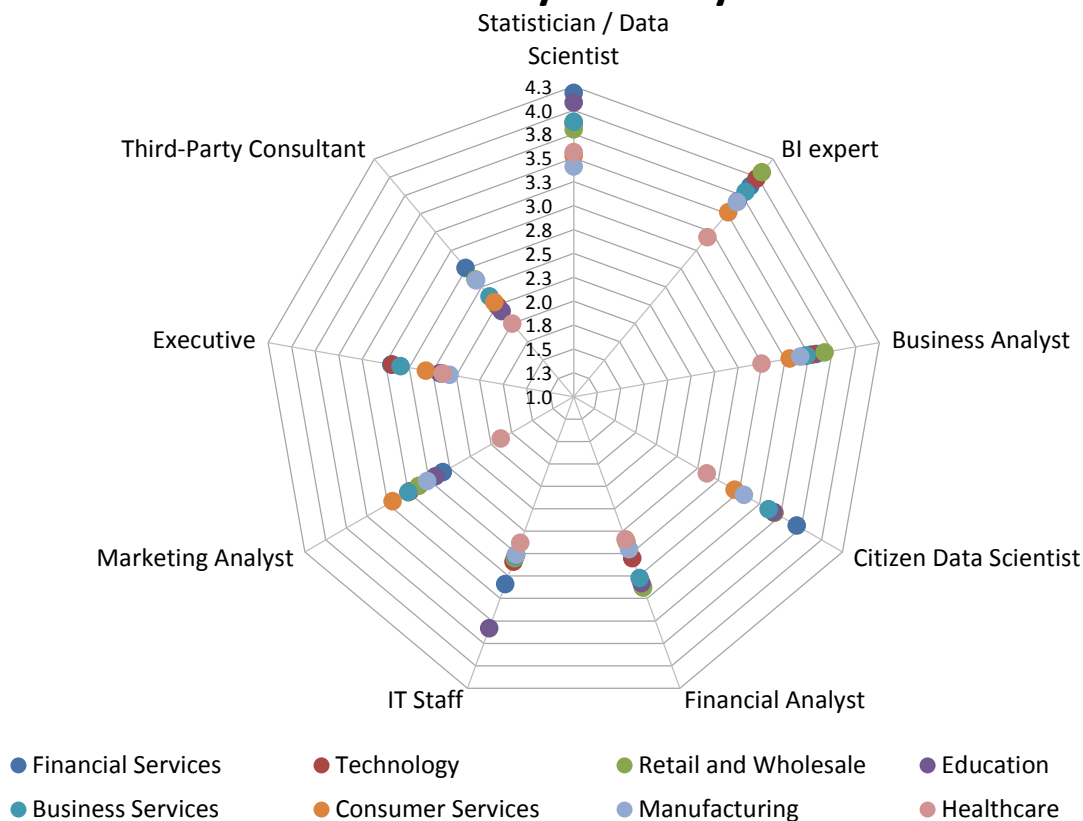


Figure 9 – AI, data science, and machine learning users by industry

2023 AI, Data Science, and Machine Learning Market Study

Users of AI, Data Science, and Machine Learning by Company Age

The frequency of data science and machine learning use by role varies unevenly by company age in 2023 (fig. 10). *Statistician / data scientist* use is slightly more common in the oldest or most mature organizations of 11 or more years. As we might guess, younger organizations of less than five years are more likely to be more frequent users as lesser and newer target audiences, including *citizen data scientist*. The youngest organizations also more frequently identify *marketing analyst*, *third-party consultants*, and by a rather wide margin, *executives*. This latter finding, in which executives in young organizations far outpace those in the oldest, might indicate that young organizations are more aware of entry-level business prospects for the technologies and find tools and use cases more approachable.

AI, Data Science, and Machine Learning Users by Company Age

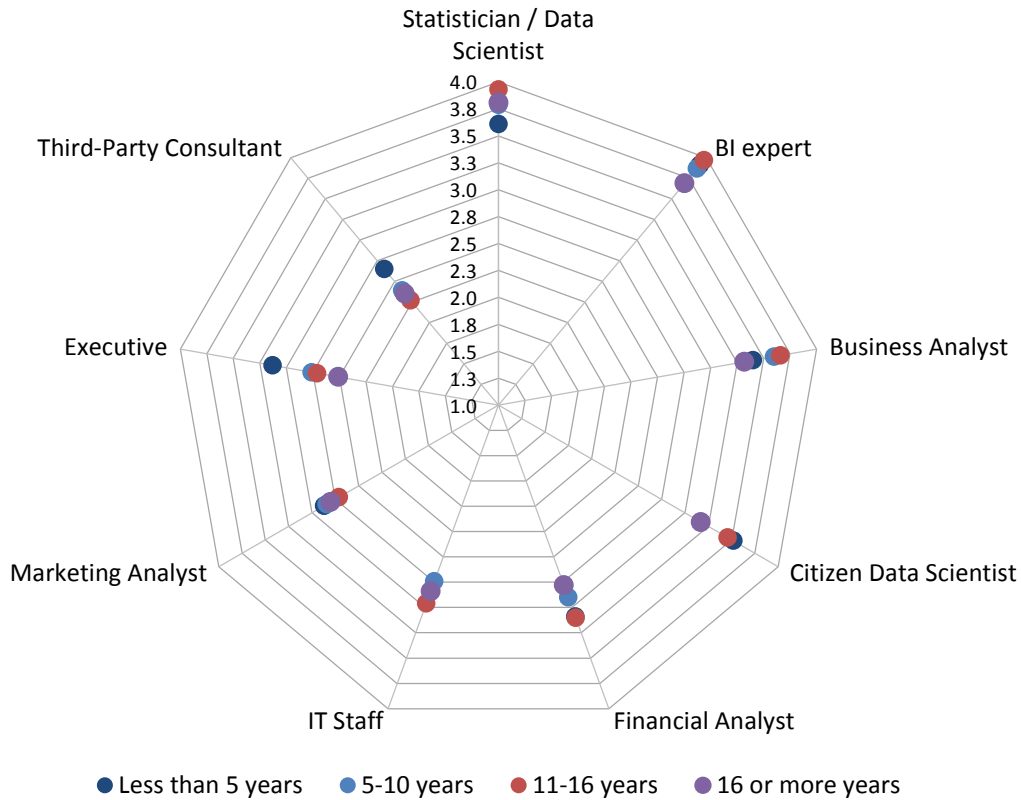


Figure 10 – AI, data science and machine learning users by company age

2023 AI, Data Science, and Machine Learning Market Study

Users of AI, Data Science, and Machine Learning by Success with BI

The use of AI, data science, and machine learning by role and frequency of use often but not always correlates to success with BI in 2023 (fig. 11). Organizations that are *completely successful* or *somewhat successful* with BI clearly lead or rank higher in the top four user roles of *statistician / data scientist*, *BI expert*, *business analyst*, and *citizen data scientist*. Degrees of BI success cluster more tightly in the use of *financial analyst* and *IT staff*. More *somewhat unsuccessful* and *unsuccessful* respondents actually report higher AI, data science, and machine learning use by *marketing analysts*, a finding that might indicate early attempts or missteps in use by that function.

AI, Data Science, and Machine Learning Users by Success with BI

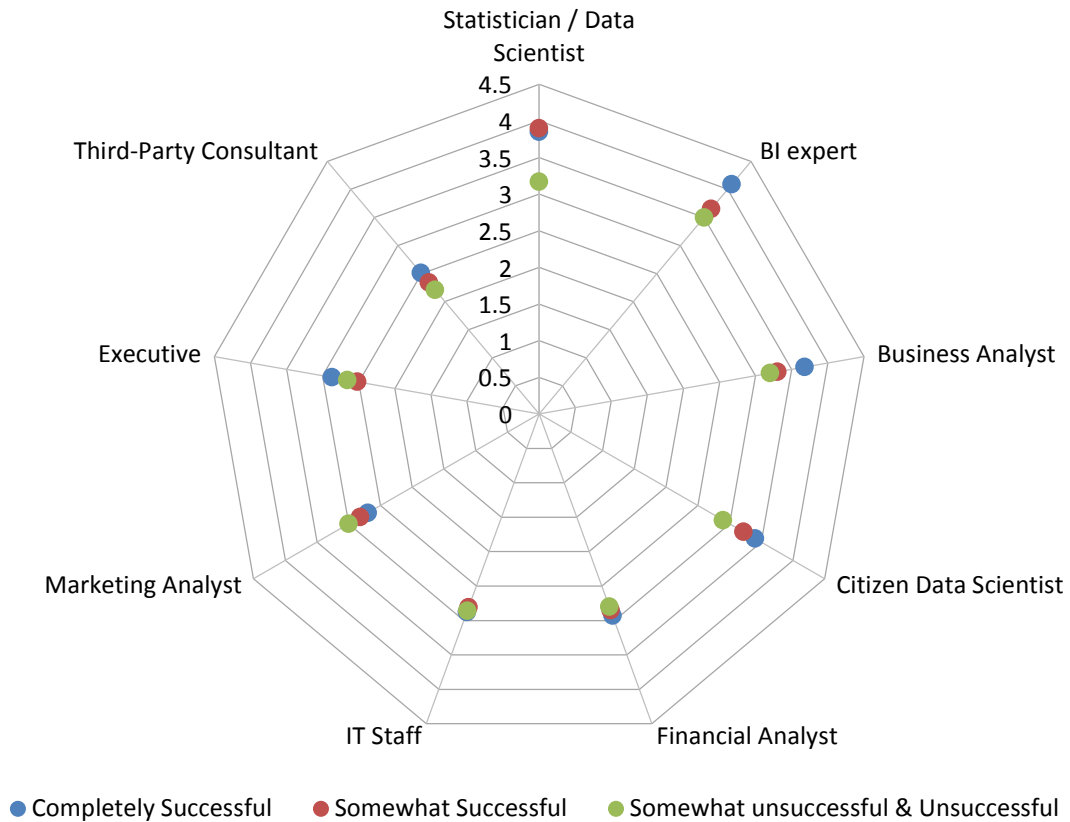


Figure 11 – AI, data science and machine learning users by success with BI

2023 AI, Data Science, and Machine Learning Market Study

Importance of AI, Data Science, and Machine Learning

Data science ranks 23rd, and cognitive BI / artificial intelligence-based BI ranks 36th among 59 topics under our study, as defined in our 2023 user survey (fig. 12).

Techonologies and Initiatives Strategic to Business Intelligence

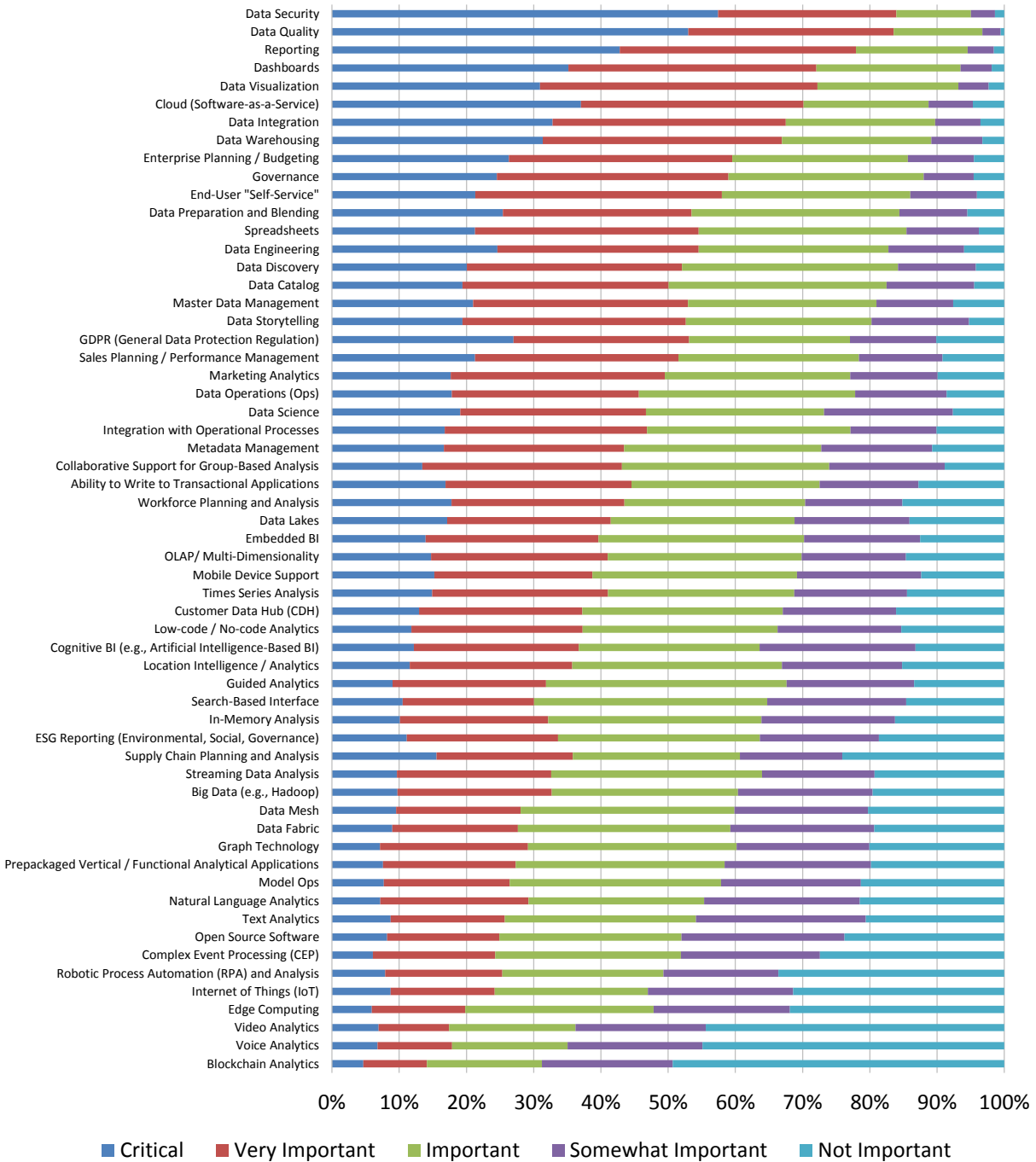


Figure 12 – Technologies and initiatives strategic to business intelligence

2023 AI, Data Science, and Machine Learning Market Study

Importance of AI, Data Science, and Machine Learning 2014-2023

In our 2023 study, the weighted-mean perceived importance of AI, data science, and machine learning stands at 3.5, lower than the historic high of 3.7 in 2022, but within a range of 3.4-3.7 that held from 2018 to the current year (fig. 13). We consider this sustained range of interest as consistently high, with some reservation for speculation remaining. This year, 79 percent consider the topic to be, at minimum, *important*, compared to 83 percent in 2022. 2023's 3.5 weighted mean is midway between *important* and *very important* on our scoring scale. Compared to the 3.4-3.7 scores of the last five years, earlier 2014-2017 weighted-mean scores stood at 3.2-3.4, a bit above a level of *important*. (Also see industry importance, fig. 70.)

Importance of AI, Data Science, and Machine Learning 2014-2023

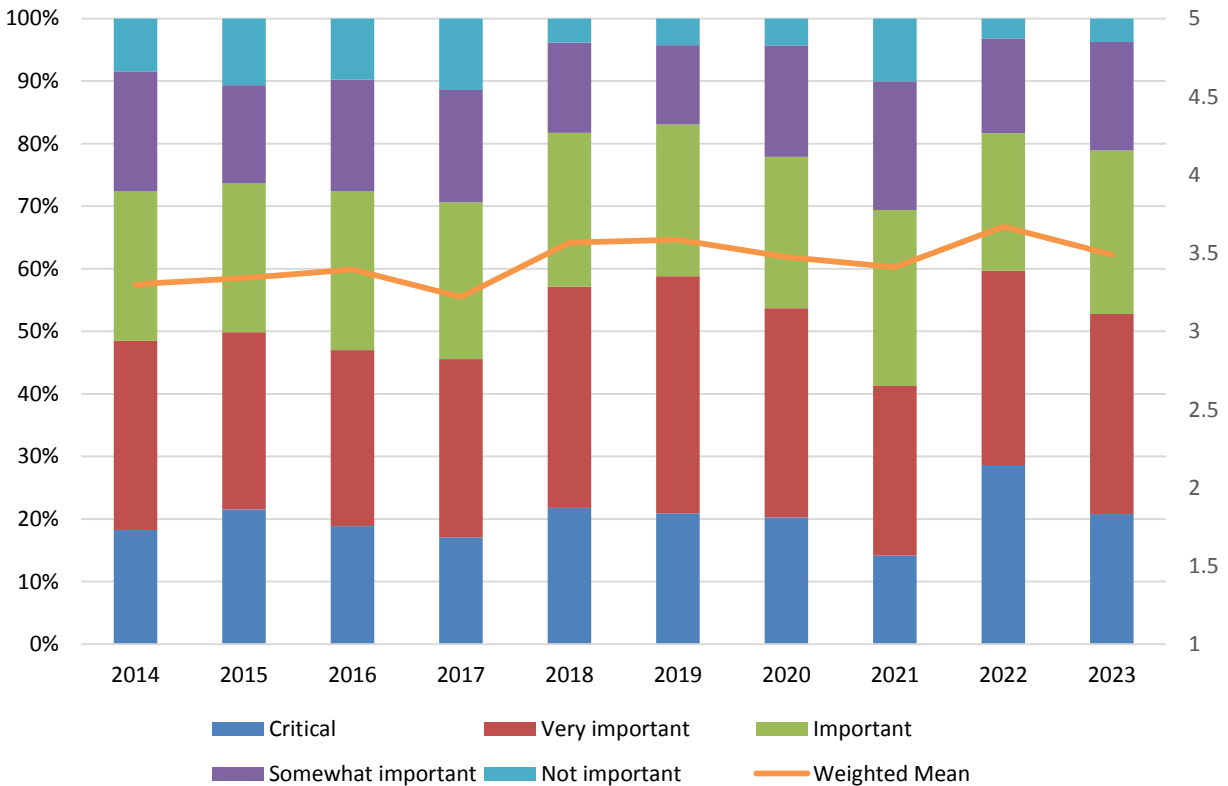


Figure 13 – Importance of AI, data science, and machine learning 2014-2023

2023 AI, Data Science, and Machine Learning Market Study

Importance of AI, Data Science, and Machine Learning by Region

Interest in AI, data science, and machine learning varies by geography in 2023, with weighted-mean interest highest in Asia Pacific (3.7), followed by North America (3.4) and EMEA (3.3) (fig. 14). Thus, all regions consider AI, data science, and machine learning to be above a level signifying *important*. Nonetheless, the percentage of *critical* importance scores is noticeably higher in Asia Pacific (28 percent), compared to North America (17 percent) and EMEA (21 percent). *Somewhat important* and *not important* scores are correspondingly reversed by region.

Importance of AI, Data Science, and Machine Learning by Geography

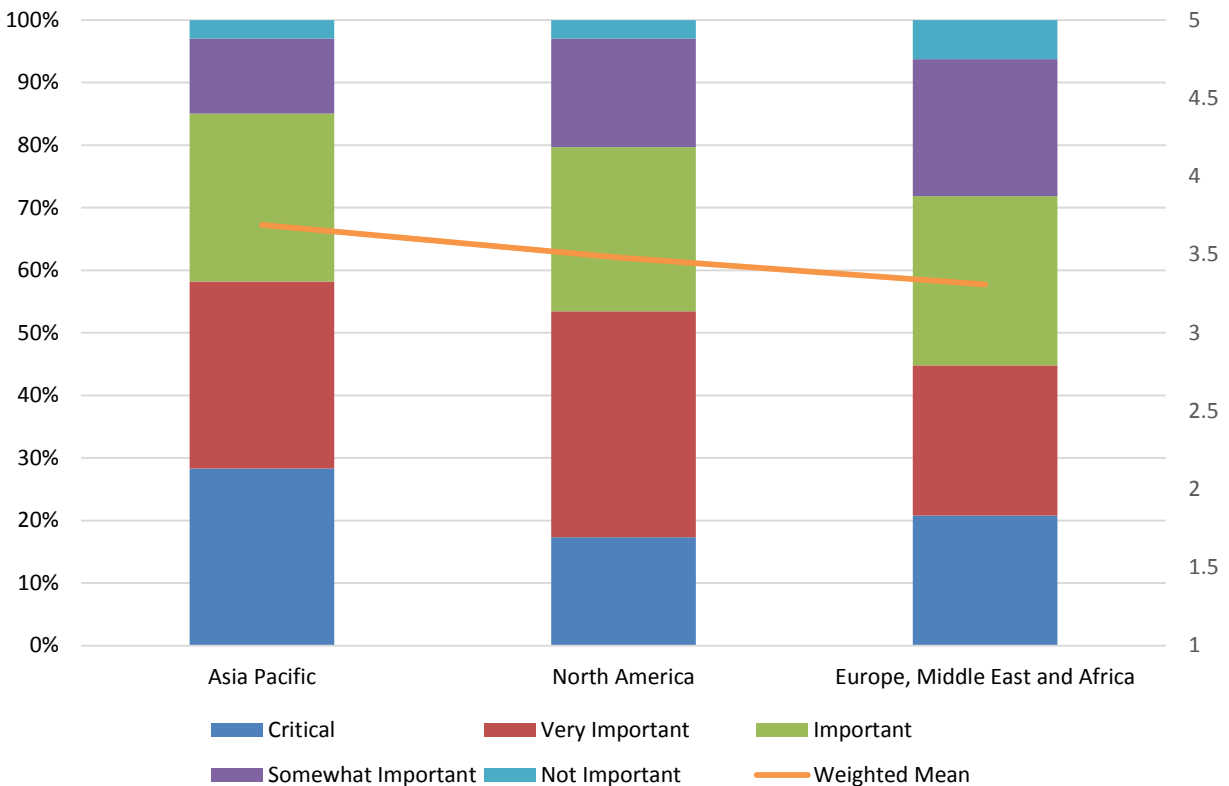


Figure 14 – Importance of AI, data science, and machine learning by geography

2023 AI, Data Science, and Machine Learning Market Study

Importance of AI, Data Science, and Machine Learning by Function

Interest in AI, data science, and machine learning is high across multiple functions in 2023, with weighted-mean values of 3.3-3.7, well or far above the level signifying *important* (fig. 15). Such broad importance scores imply high enterprise awareness and interest. This year, sentiment is highest in *R&D*, *BICC*, and *sales and marketing* (all weighted-mean 3.7), and trails off only slightly among respondents in strategic planning (3.6), IT (3.5) and operations (3.4). *BICC* reports the highest combined *critical* and *very important* scores (67 percent), which is often a departmental indicator of urgency or enterprise deployment. Least interested by role are *executives* and respondents in *finance*, though these roles also report relevance well above the level of *important*.

Importance of AI, Data Science, and Machine Learning by Function

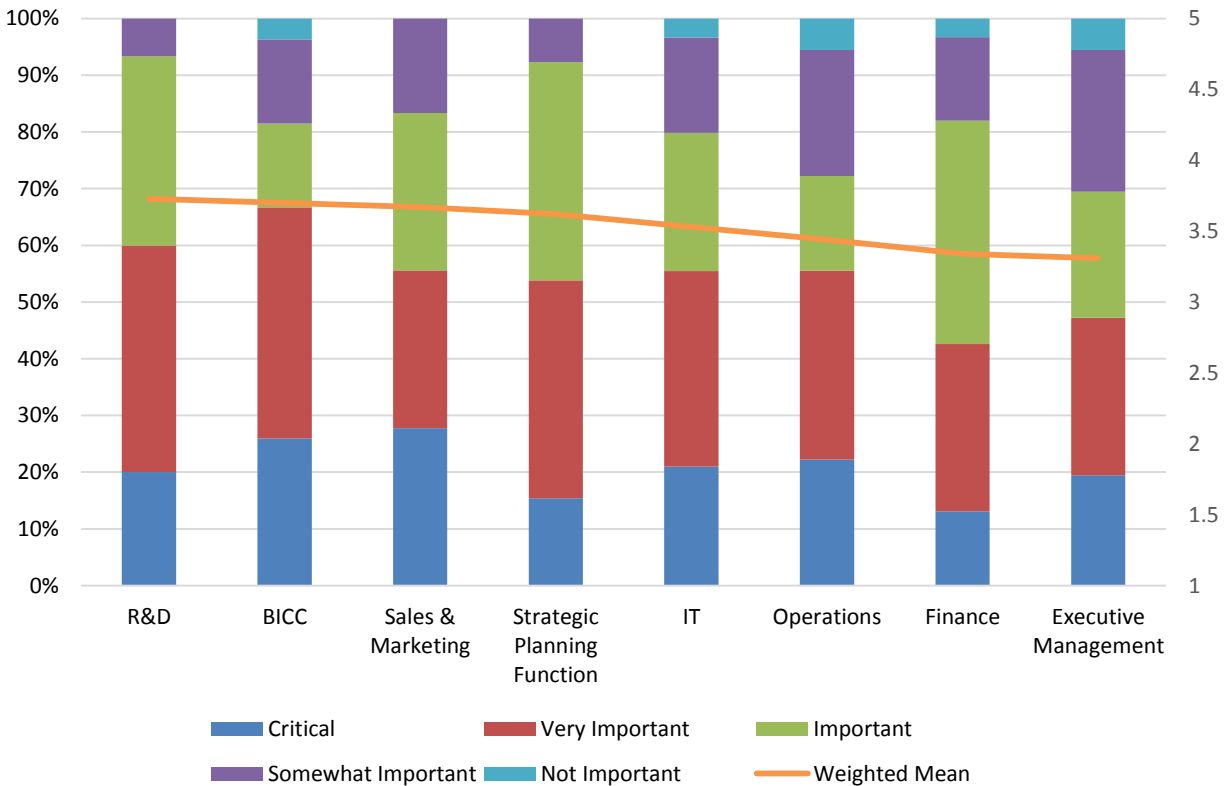


Figure 15 – Importance of AI, data science, and machine learning by function

2023 AI, Data Science, and Machine Learning Market Study

Importance of AI, Data Science, and Machine Learning by Industry

Among eight vertical industries we sampled in 2023, all give AI, data science, and machine learning somewhat or far higher than *important* scores ranging from 3.2-3.9 (fig. 16). This year, respondents in *financial services* give the highest score, *above 3.9*, near *very important*, followed by *education* and *technology* (both 3.6). *Education* respondents report the highest combined critical and very important scores (65 percent), which likely includes heightened academic as well as professional attention to the subjects. At the other end of the spectrum, *healthcare* respondents post the most conservative score (3.2), but nonetheless assign a score that is higher than *important*. *Retail and wholesale*, *manufacturing*, *business services*, and *consumer services* (3.2-3.4) round out the field of interest.

Importance of AI, Data Science, and Machine Learning by Industry

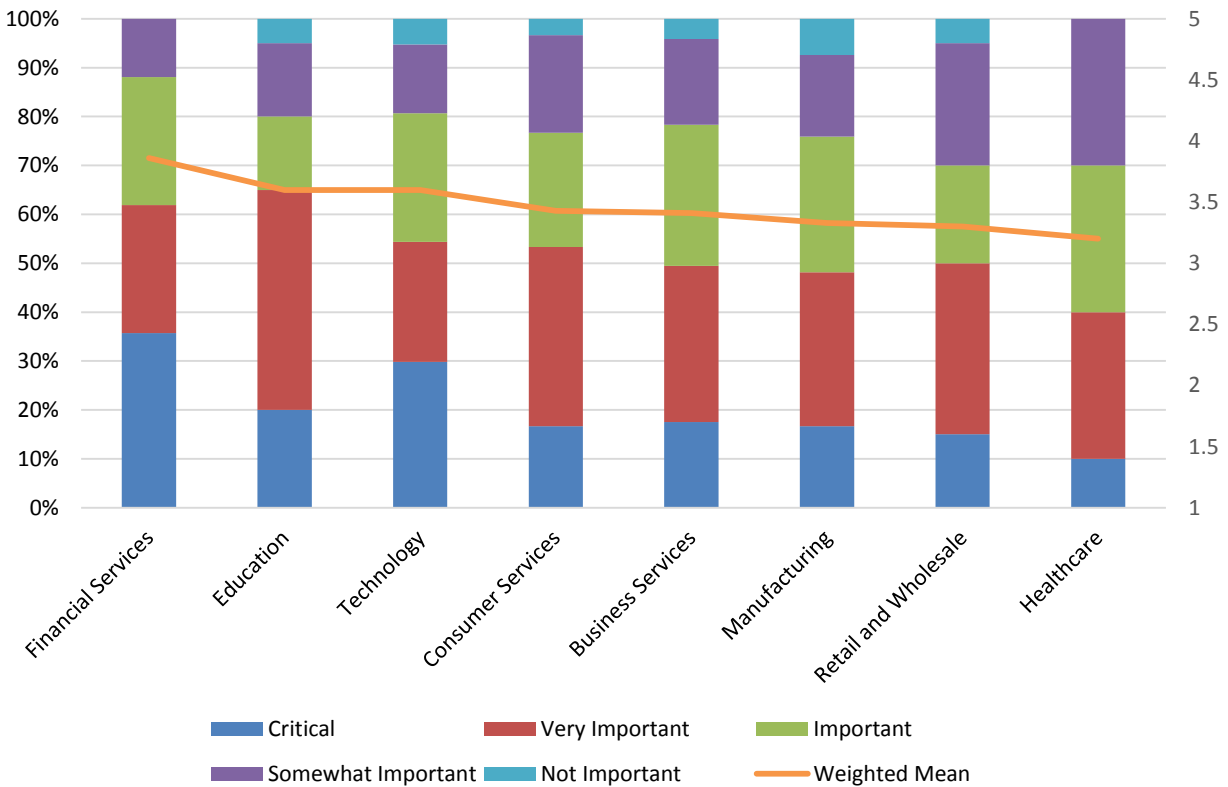


Figure 16 – Importance of AI, data science, and machine learning by industry

2023 AI, Data Science, and Machine Learning Market Study

Importance of AI, Data Science, and Machine Learning by Organization Size

In our 2023 study, the importance of AI, data science, and machine learning increases with organization headcount, especially in the case of very large (> 10,000 employees) organizations (fig. 17). Indeed, AI, data science, and machine learning are uniquely important to very large organizations, which attach the highest weighted-mean value (3.9, effectively *very important*), and the highest combined *critical* and *very important* scores (66 percent). We might also expect that broad functional usage (see fig. 15, p. 31), is most likely in very large organizations. Along with high interest in the largest enterprises, we also see well above *important* scores (weighted-mean 3.3-3.5), in all smaller peer organizations.

Importance of AI, Data Science, and Machine Learning by Organization Size

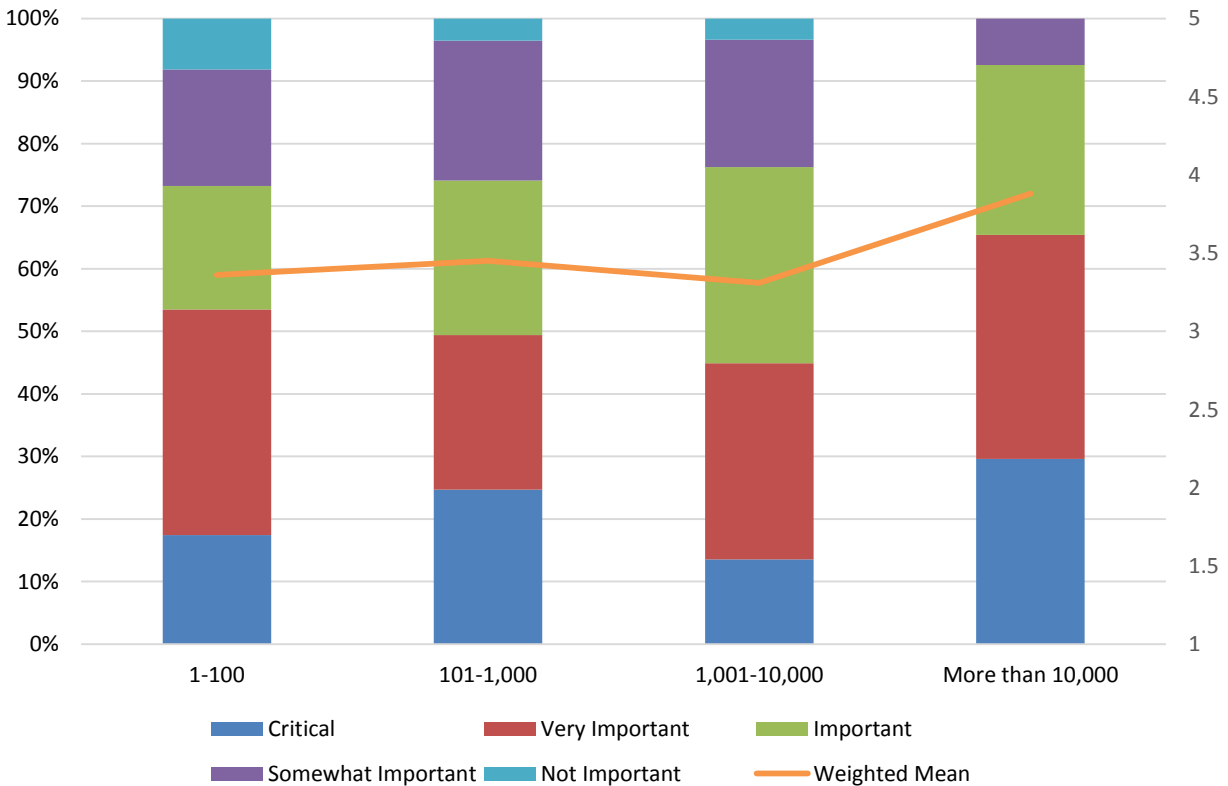


Figure 17 – Importance of AI, data science, and machine learning by organization size

2023 AI, Data Science, and Machine Learning Market Study

Importance of AI, Data Science, and Machine Learning by Business Intelligence Success

The perceived importance of AI, data science, and machine learning correlates with organizational success with BI in 2023 (fig. 18). Organizations that are *completely successful* with BI are far more likely (31 percent) to say AI, data science and machine learning are *critical*, compared to those that are *somewhat successful* (17 percent) and more than twice as likely as those reporting *somewhat unsuccessful* or *unsuccessful* (13 percent). Alongside this correlation, we also observe relatively high combined *critical* and *very important* scores (55 percent) in organizations that are *somewhat unsuccessful and unsuccessful* with BI, an indication that awareness and attention to importance are not guarantors of BI success.

Importance of AI, Data Science, and Machine Learning by Success with BI

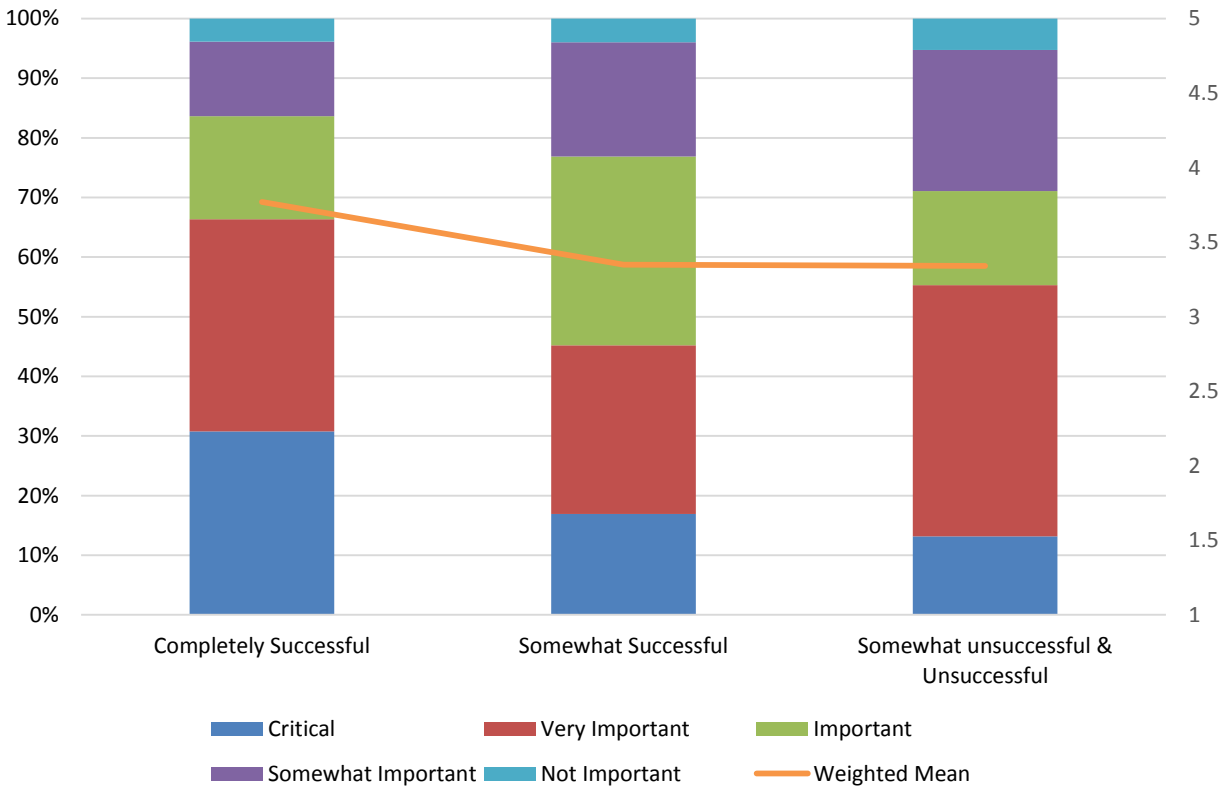


Figure 18 – Importance of AI, data science, and machine learning by BI success

Use Cases for AI, Data Science, and Machine Learning

On the execution end of AI, data science, and machine learning, we asked respondents to describe the relevance of 13 different use cases for the technology (fig. 19). We can describe *current* usage as quite low and future plans prospective, with top use cases, *customer segmentation* and *demand forecasting*, applied by just 21 and 19 percent of respondents, respectively. *Demand forecasting* is the lone use case where respondents expect current and future use plans to involve more than half of respondents. Even so, we describe current interest as “across the board,” with more than half the top early-stage uses applied to roles and processes involving sales, marketing, planning, and forecasting. Thus, front-office use is currently ahead of risk, fraud, quality, and maintenance applications. We also see the largest plurality of responses scores invariably applied to “*don’t know*,” a clear reminder of immaturity and green-field prospects for AI, data science, and machine learning.

Use Cases for AI, Data Science, and Machine Learning

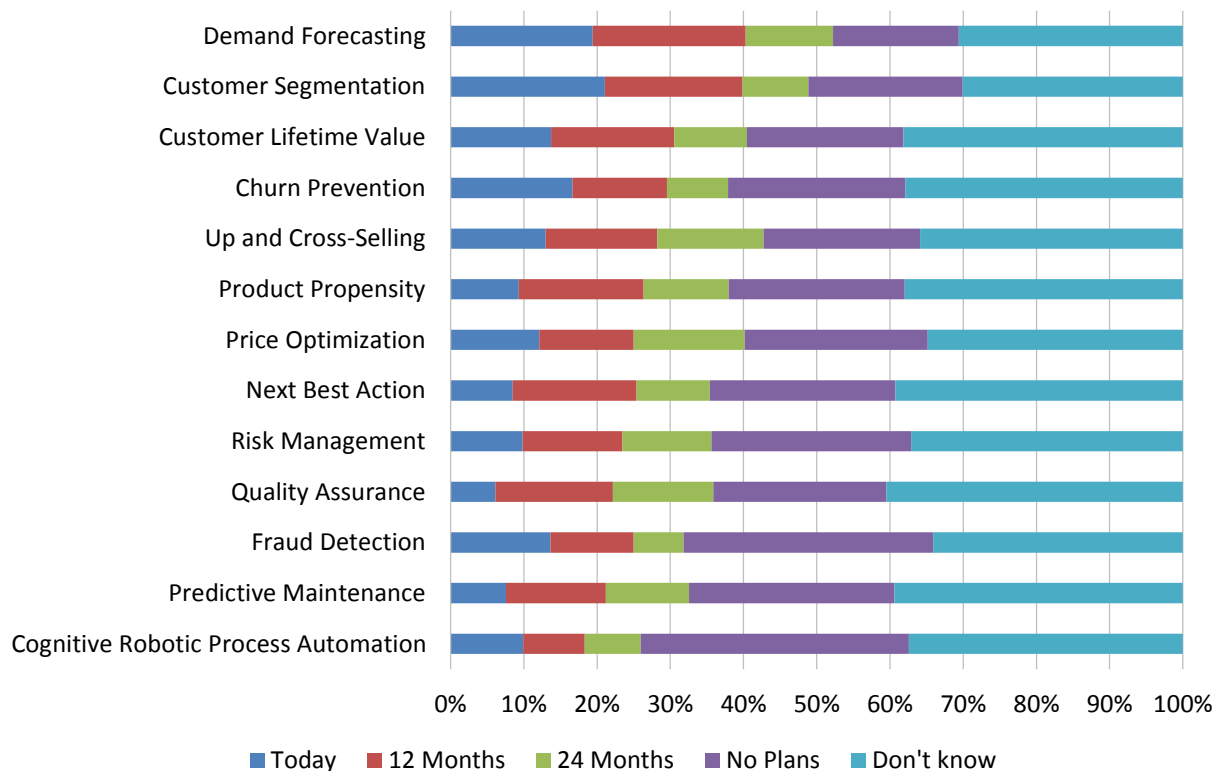


Figure 19 – Use cases for AI, data science, and machine learning

2023 AI, Data Science, and Machine Learning Market Study

Use Cases for AI, Data Science, and Machine Learning by Geography

We observe regional preferences regarding the current and future use of AI, data science, and machine learning in 2023 (fig. 20). Asia Pacific leads in use case importance in several areas, including *churn prevention*, *fraud detection*, and some lower-ranked uses; but it distinctly lags in other areas. For example, *customer lifetime value* and *customer segmentation*, common to sales and marketing processes, are of the highest interest to respondents in North America and EMEA. Similarly, *demand forecasting* is more commonly important to both EMEA and North America respondents, as are *price optimization* and *up- and cross-selling*. While interesting, some of these use cases overlap front- and back-office processes, roles, and industries; and we consider this representation an early snapshot of regional use.

Use Cases for AI, Data Science, and Machine Learning by Geography

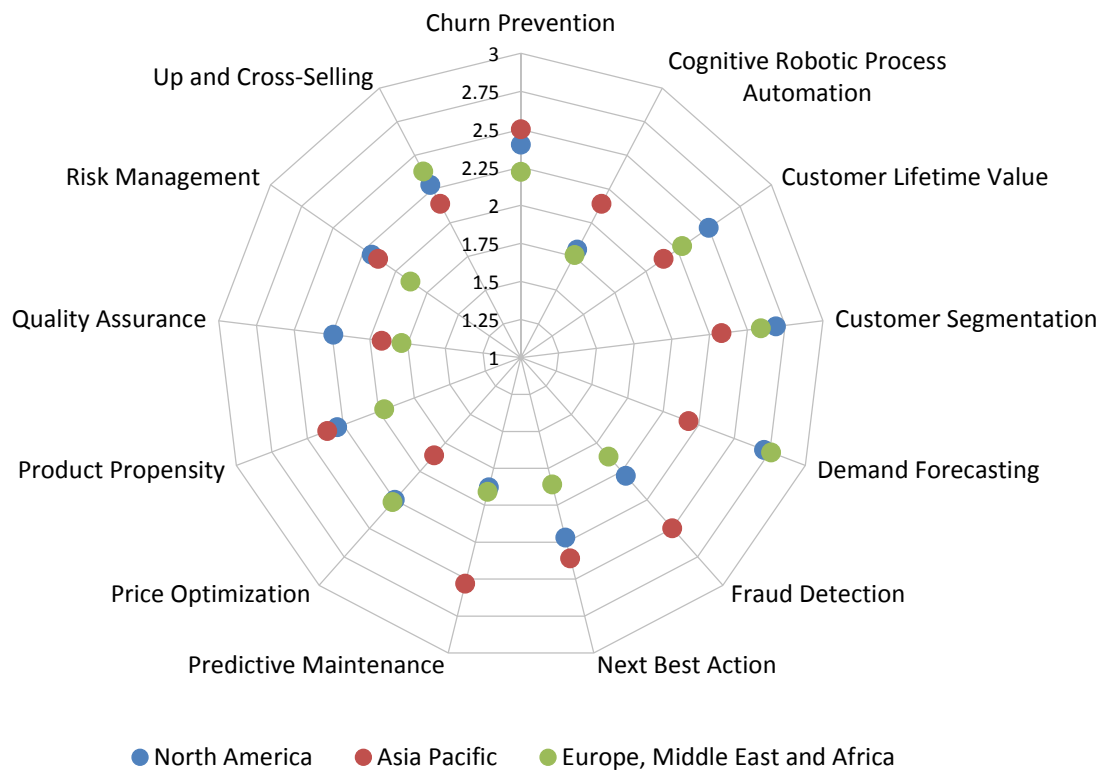


Figure 20 – Use cases for AI, data science, and machine learning by geography

2023 AI, Data Science, and Machine Learning Market Study

Use Cases for AI, Data Science, and Machine Learning by Function

Interest in use cases for AI, data science, and machine learning varies interestingly by function in 2023 (fig. 21). This year, *BICC* user interest (which is often indicative of actual, prospective, or speculative use), leads several use cases, often notably. These include *churn prevention*, *up- and cross-selling*, *risk management*, and, to lesser degrees, *product propensity*, *fraud detection*, and *customer segmentation*. Also interesting is considerable *finance* interest in expected and possibly unexpected use cases. These include *demand forecasting*, *predictive maintenance*, and *customer lifetime value*, as well as *price optimization* and *cognitive robotic process automation*. Relatively lower *executive* interest in most use cases may reflect a still-immature enterprise environment for AI, data science, and machine learning.

Use Cases AI, Data Science, and Machine Learning by Function

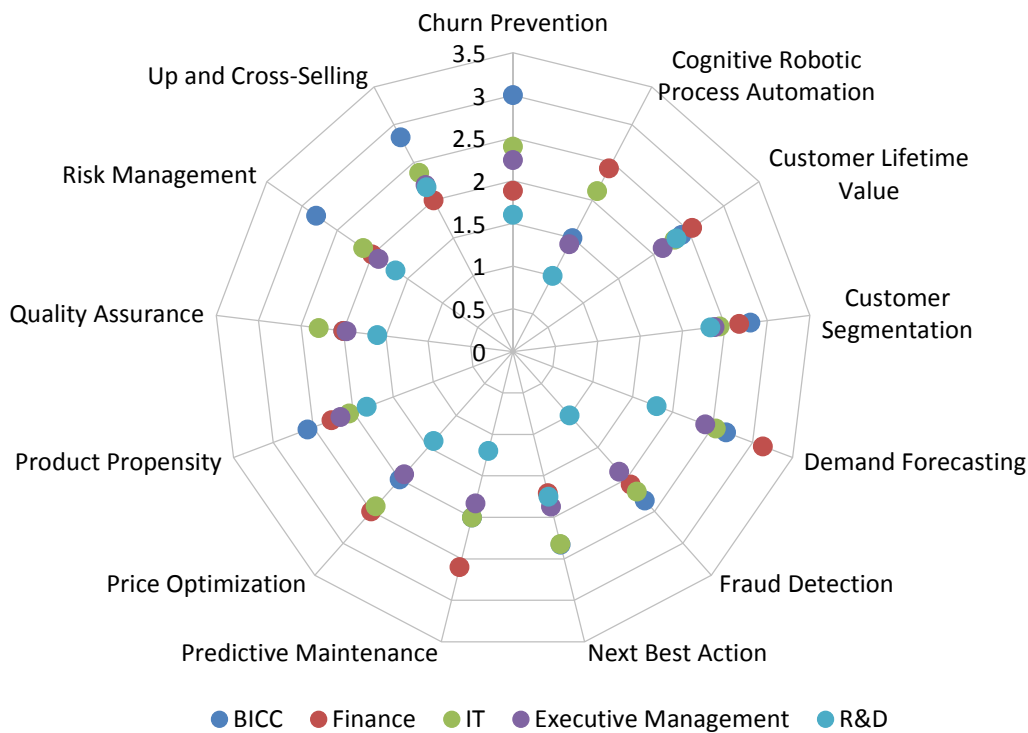


Figure 21 – Use cases for AI, data science, and machine learning by function

2023 AI, Data Science, and Machine Learning Market Study

Use Cases for AI, Data Science, and Machine Learning by Industry

Viewed by industry, 2023 interest in use cases for AI, data science, and machine learning varies greatly, with some early evidence of leaders and laggards (fig. 22). Among the leaders are respondents in *financial services* and *technology* organizations. *Financial services* organizations in particular report outsized interest in areas including *churn prevention*, *fraud detection*, *risk management*, *next-best action*, and *price optimization*. Financial services organizations also lead in use cases for *quality assurance*, *customer segmentation*, and *customer lifetime value*. *Technology* organizations also show secondary or above-average interest in several areas. Other industries report selective interest. *Retail and wholesale*, for example, reports very high interest in *customer lifetime value* and *customer segmentation*; but it distinctly lags in lower-ranked use cases. *Healthcare* is notably a laggard in areas other than *demand forecasting* and *next-best action*. In all, multiple industries report broad to narrow interest in multiple use cases for AI, data science, and machine learning.

Use Cases for AI, Data Science, and Machine Learning by Industry

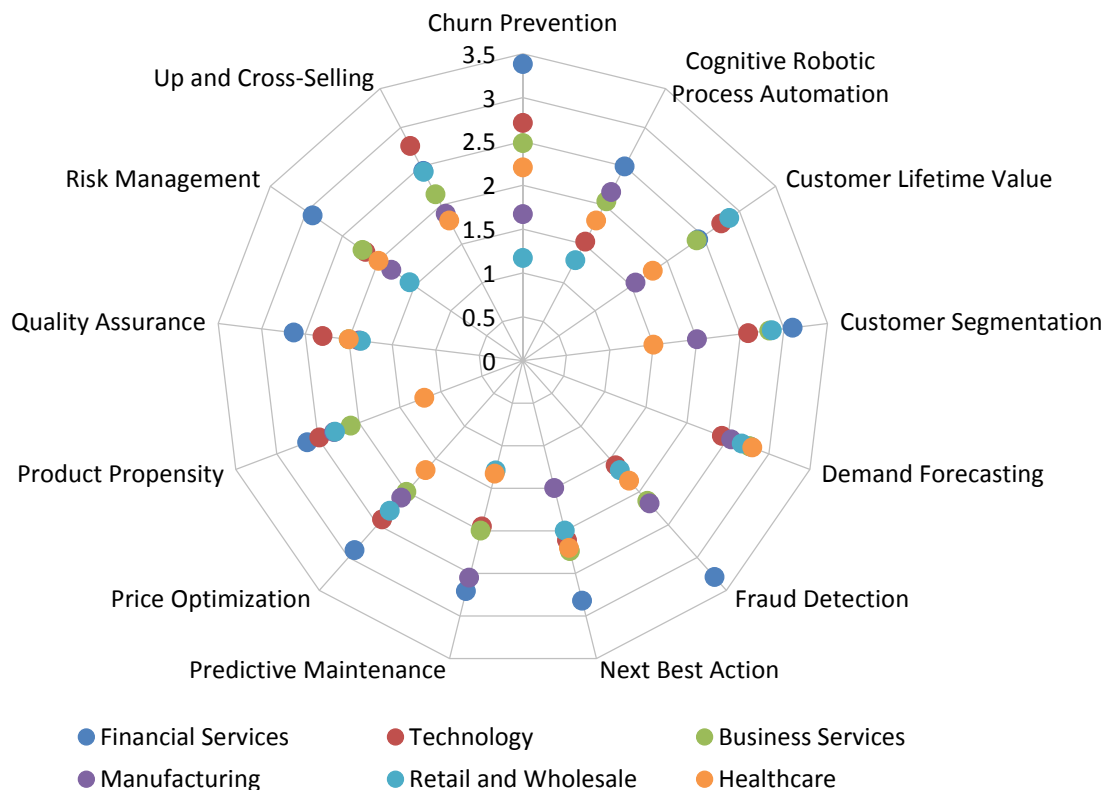


Figure 22 – Use cases for AI, data science, and machine learning by industry

2023 AI, Data Science, and Machine Learning Market Study

Use Cases for AI, Data Science, and Machine Learning by Organization Size

Interest in use cases for AI, data science, and machine learning is primarily and for now a very large organization (> 10,000 employees) phenomenon (fig. 23). Very large organizations lead 2023 interest in all use cases, with standout areas of attention that include *price optimization*, *demand forecasting*, *predictive maintenance*, *customer segmentation*, *quality assurance*, and *next-best action*. While small organizations (1-100 employees) almost always express the lowest interest in use cases, headcount does not always indicate use case interest. Midsize organizations (101-1,000 employees), for example, report higher-than-average interest in areas including *churn prevention*, *customer lifetime value*, *customer segmentation*, *next-best action*, and *risk management*. We conclude that use case interest, while dominated by very large organizations, is of situational interest to organizations of any size.

Use Cases for AI, Data Science, and Machine Learning by Organization Size

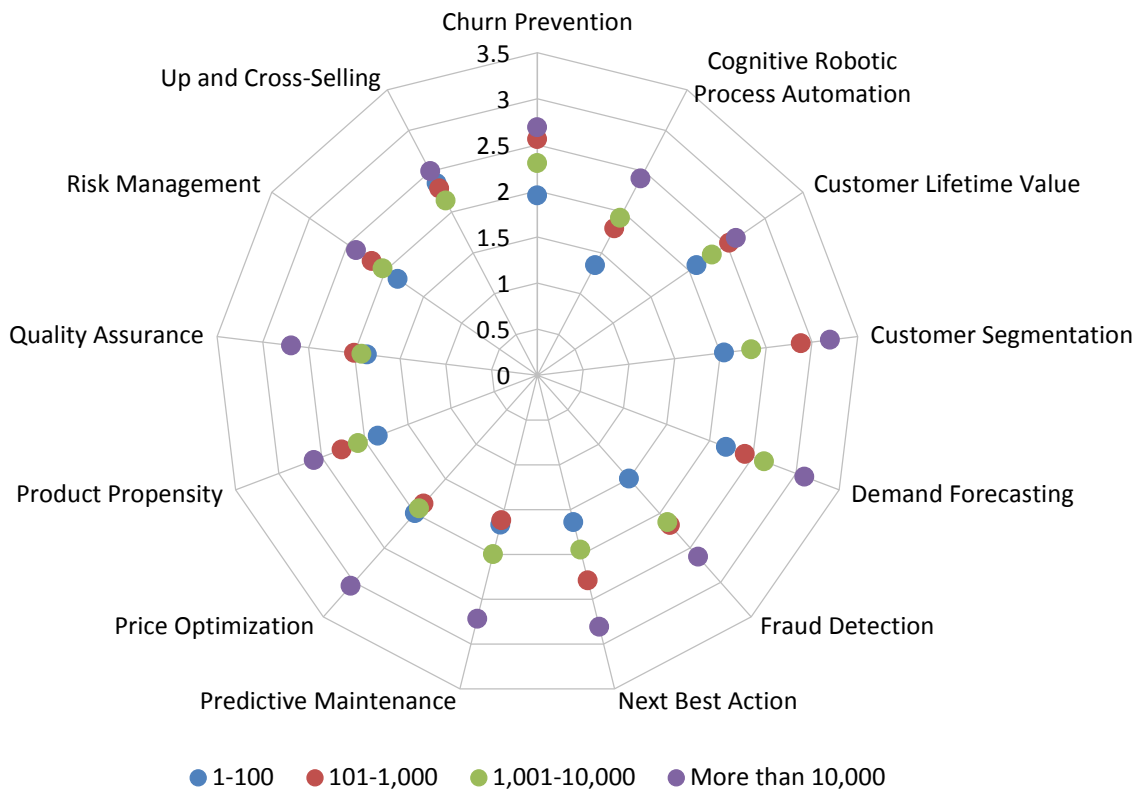


Figure 23 – Use cases for AI, data science, and machine learning by organization size

2023 AI, Data Science, and Machine Learning Market Study

Use Cases for AI, Data Science, and Machine Learning by Company Age

Attention to use cases for AI, data science, and machine learning varies unevenly but sometimes intuitively by company age in 2023 (fig. 24). This year, for example, the oldest (16 years or more) organizations show relatively dominant interest in longstanding business practices and measures including *customer lifetime value*, *customer segmentation*, *demand forecasting*, *fraud protection*, and *up- and cross-selling*. In contrast, younger organizations of less than five, or 5-10 years, give high or relatively high importance to *cognitive robotic process automation*, *price optimization*, *risk management*, and *product propensity*. The rule of age is not hard and fast, however: some results are clustered across companies of different age, and some newer practices, such as *next-best action* are presently most explored by the “oldest” organizations.

Use Cases for AI, Data Science, and Machine Learning by Company Age

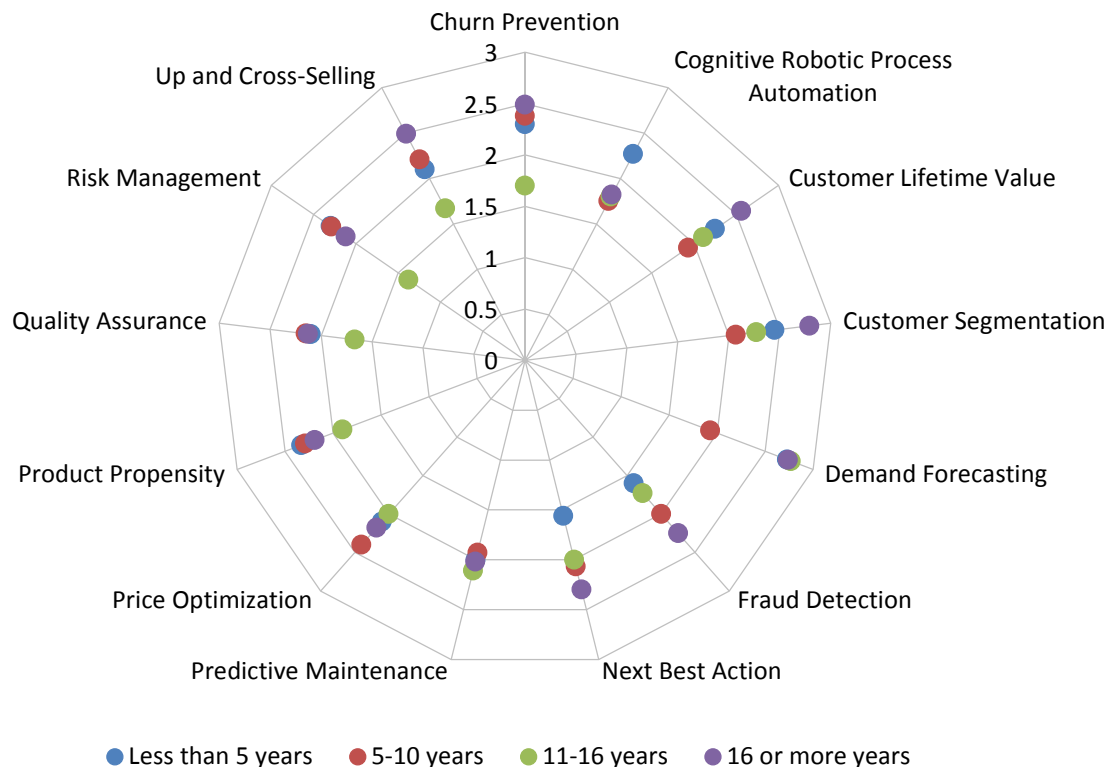


Figure 24 – Use cases for AI, data science, and machine learning by company age

Use Cases for AI, Data Science, and Machine Learning by Success with BI

Success with business intelligence (BI) sometimes but not always relates to interest/attention to specific use cases for AI, data science, and machine learning (fig. 25). Variations in success by use case might be attributed to many causes including organizational competency/maturity, complexity, data fitness, or other factors. Without evidence of causation, we can say that organizations that focus on *demand forecasting*, *fraud detection*, *predictive maintenance*, *risk management*, and *cognitive robotic process optimization* are also most likely to report they are completely successful with BI. Organizations that focus on *up- and cross-selling*, *product propensity*, and *next-best action* are relatively more likely to report being *somewhat unsuccessful* or *completely unsuccessful* with BI.

Use Cases for AI, Data Science, and Machine Learning by Success with BI

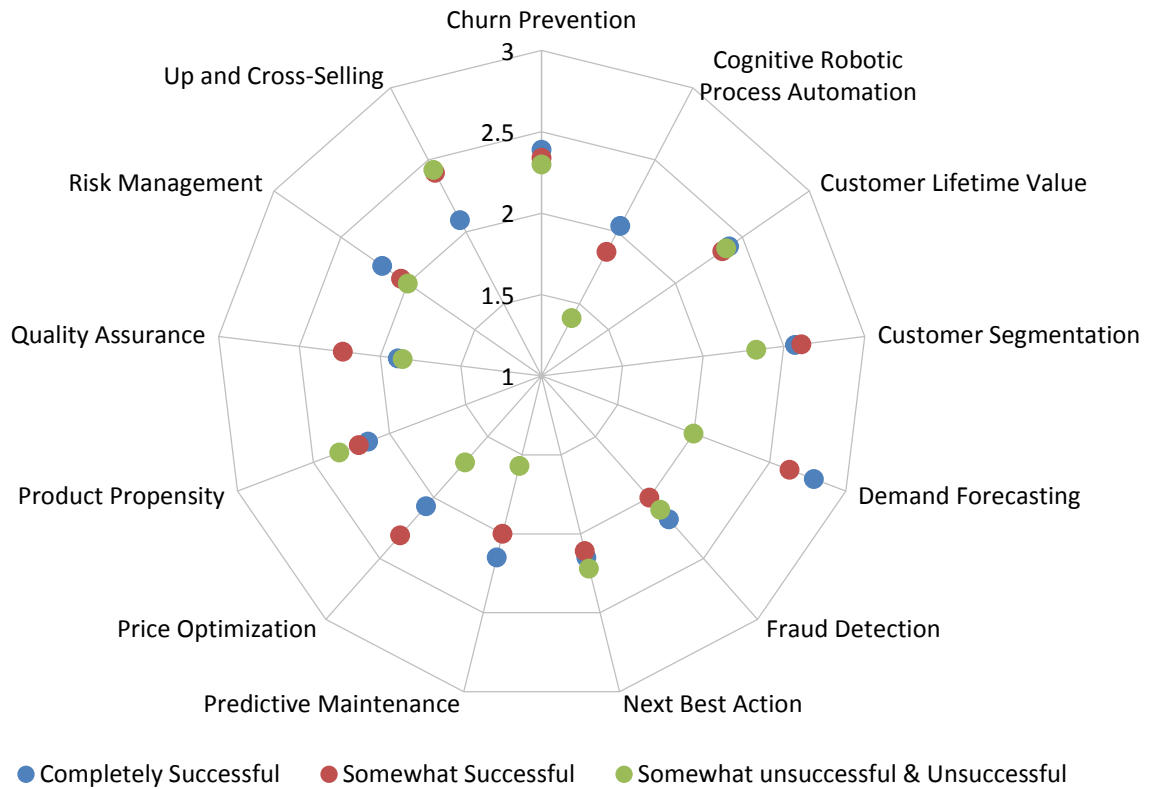


Figure 25 – Use cases for AI, data science, and machine learning by success with BI

Use Cases for AI, Data Science, and Machine Learning by Generative AI Adoption

Organizations that are adopting or considering the use of generative AI prioritize some use cases over others (fig. 25). For example, *churn prevention, customer segmentation, next-best action, and price optimization* are the most important use cases to organizations that are *experimenting today and in production today*. Use cases *planned for use in 12 months* include *up- and cross-selling, quality assurance, and risk management*. Some widely planned, prioritized use cases deferred *beyond 12 months* include *customer lifetime value, customer segmentation (again); demand forecasting, and product propensity*. We nonetheless consider all use case scenarios, including *no plans*, to be subject to industry and other demographics, product/service maturity, and future needs.

Use Cases for AI, Data Science, and Machine Learning by Generative AI Adoption

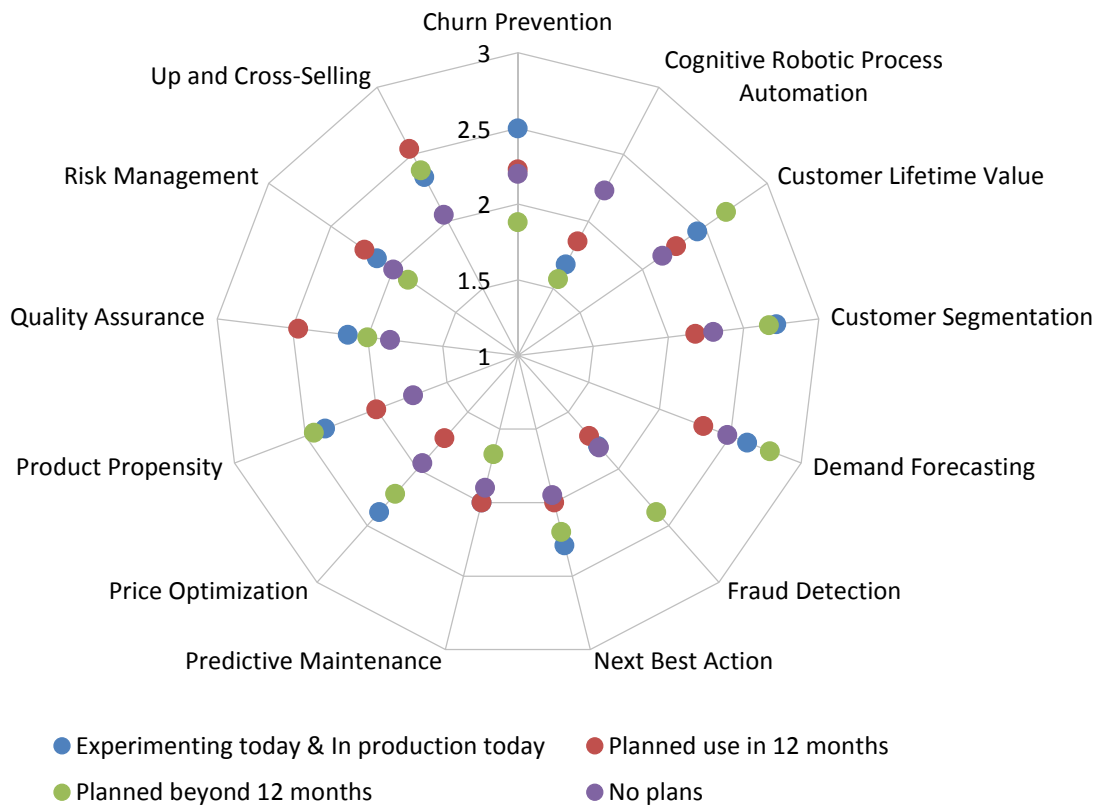


Figure 26 – Use cases for AI, data science, and machine learning by generative AI adoption

2023 AI, Data Science, and Machine Learning Market Study

Deployment and Adoption Plans for AI, Data Science, and Machine Learning

Deployment of AI, Data Science, and Machine Learning 2016-2023

Across the last eight years of our study, both consideration of and actual deployment of AI, data science, and machine learning steadily gains traction (fig. 27). (In 2022 and 2023, we divided “yes, we use today” into “in production” and “in very limited ways,” and adjusted weighted mean.) From a 2017 weighted-mean low of 2.36, 2023 current use stands at 3.00, above the level of *important* and fractionally lower than the 3.17 high seen in 2022. Current use (of any type) rose dramatically to stand at 55 percent in 2022, before falling back to 50 percent in 2023. Both recent years are well above a low of 23 percent in 2017. Those with *no plans* grew to 15 percent in 2023 from an all-time low of 9 percent in 2022, possibly indicating some hesitancy amid market events. Even so, the ongoing momentum in the AI, data science, and machine learning space bodes well for wide adoption of both production and pilot use (also see perceived importance, fig. 13).

Deployment of AI, Data Science, and Machine Learning 2016-2023

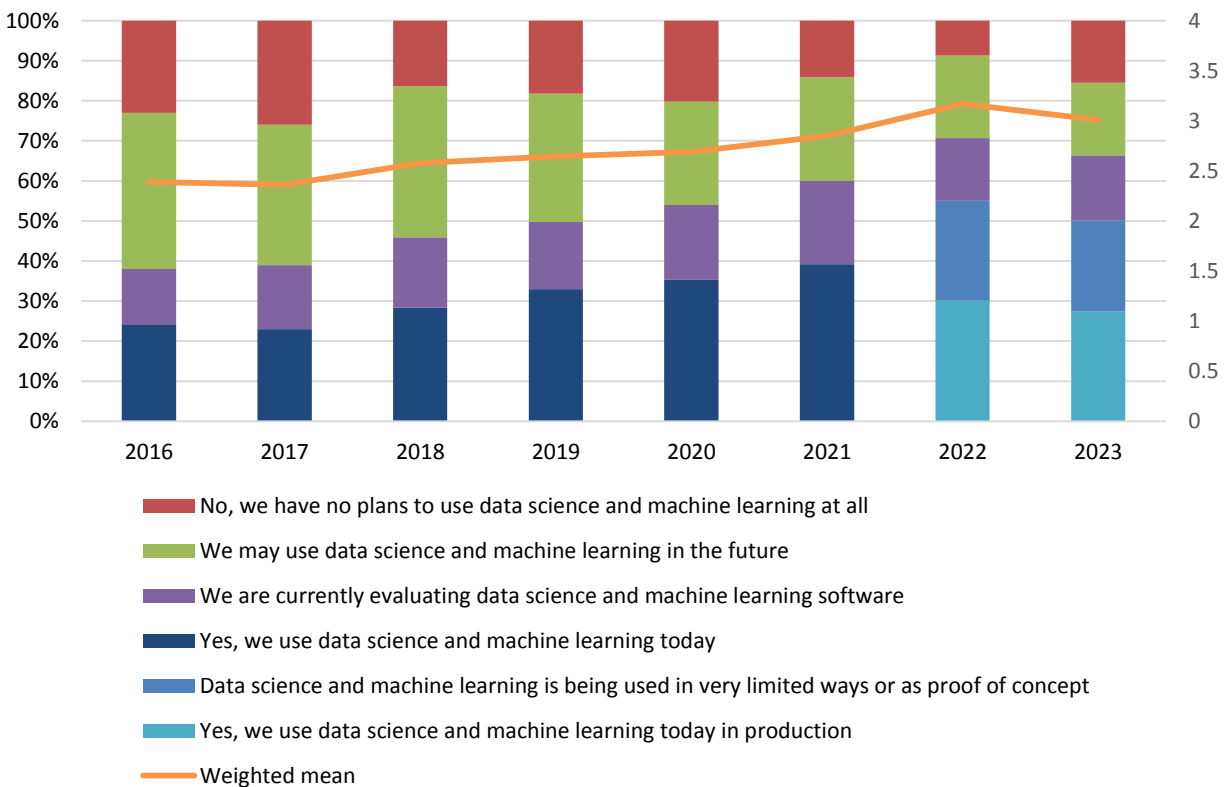


Figure 27 – Deployment of AI, data science, and machine learning 2016-2023

2023 AI, Data Science, and Machine Learning Market Study

Deployment of AI, Data Science, and Machine Learning by Geography

Deployment rates of AI, data science, and machine learning vary by geography in 2023 with both current and weighted-mean use visibly highest in Asia Pacific (fig. 28). The rate of *current production* plus *limited use* stands at 65 percent in Asia Pacific, compared to about 47 percent in both EMEA and North America. Interestingly, North America respondents are least committed to future use, with slightly more than 40 percent reporting that they either *may use* in the future or have *no plans* for AI, data science, and machine learning.

Deployment of AI, Data Science, and Machine Learning by Geography

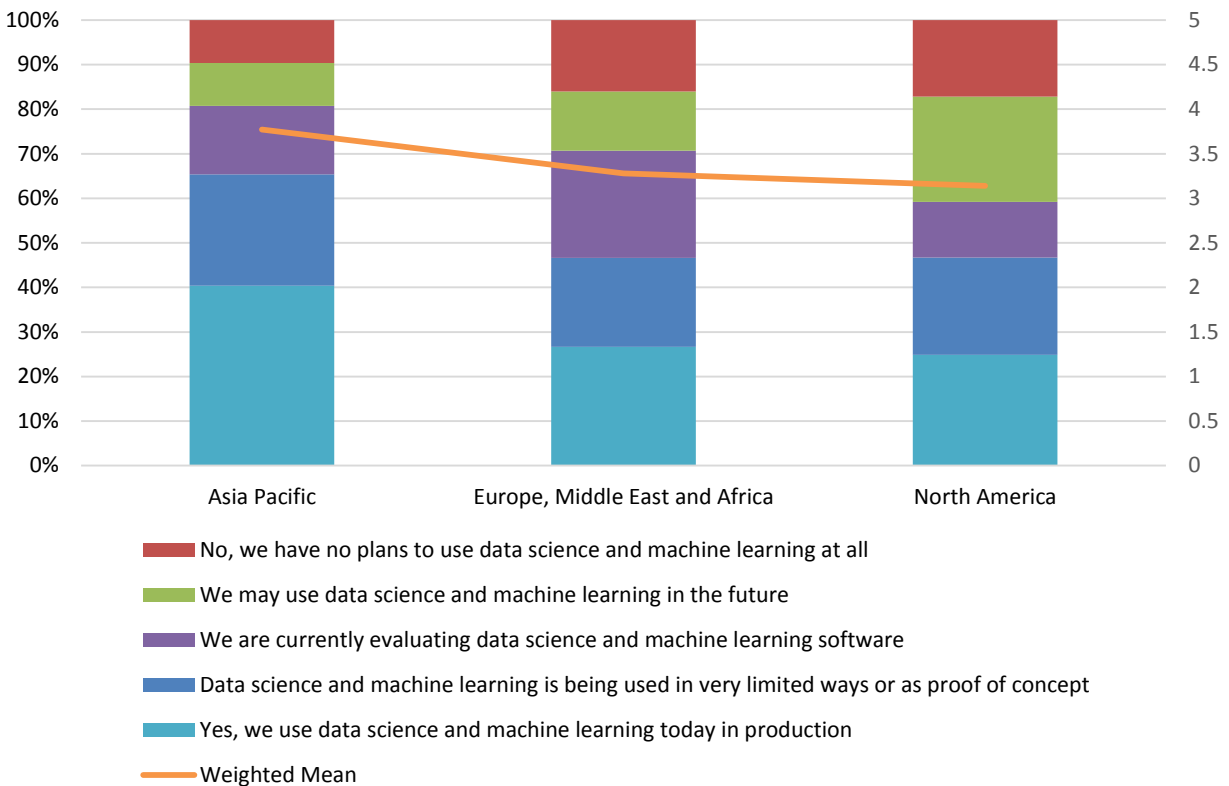


Figure 28 – Deployment of AI, data science, and machine learning by geography

2023 AI, Data Science, and Machine Learning Market Study

Deployment of AI, Data Science, and Machine Learning by Function

Current deployment of AI, data science, and machine learning is broadly distributed across functions. Indeed, all functions, with the exception of *strategic planning* and *finance*, report current combined *production* and *limited use* at 50 percent or greater (fig. 29). Among these, *BICC* and *R&D* (functions that often signal prioritization or imminent deployment), report the highest *production/limited use*, at 53 and 55 percent respectively. Similarly, *operations* (53 percent), *executive management* (51 percent), *sales and marketing* (50 percent), and *IT* (50 percent), report significant use that support the broad deployment theme. Deployment in *strategic planning* and *finance* is lower but not inconsiderable, though these functions report the highest rates of *may use* *in the future* and *no plans*.

Deployment of AI, Data Science, and Machine Learning by Function

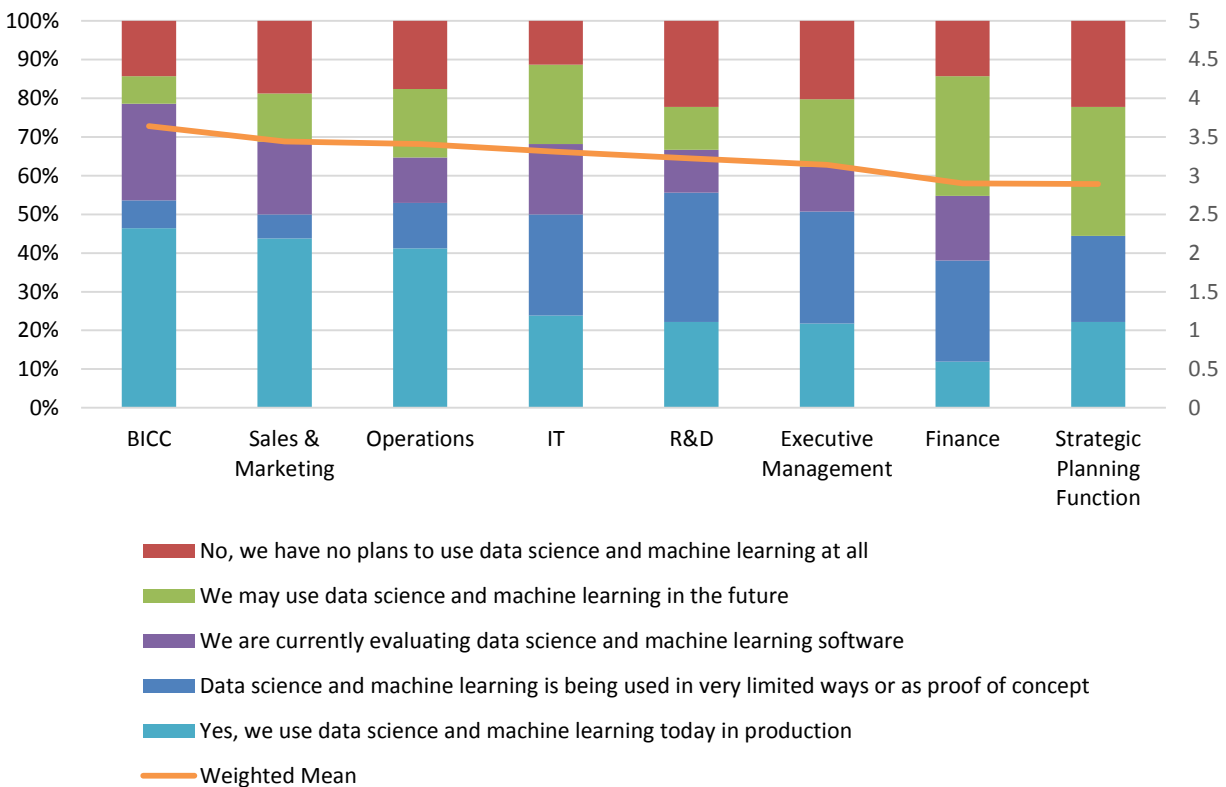


Figure 29 – Deployment of AI, data science, and machine learning by function

2023 AI, Data Science, and Machine Learning Market Study

Deployment of AI, Data Science and Machine Learning by Industry

Viewed by industry, respondents in *financial services* appear to have a first-mover edge in deployment of AI, data science, and machine learning (fig. 30). In 2023, this lead applies to current *production* and *limited* use (70 percent), as well as weighted mean likelihood to deploy. *Consumer services* is the next most likely to report either current *production* or *limited* use (54 percent), though weighted-mean deployment scores are in a similar range of 3.2-3.4 for *consumer services* as well as *education, technology, retail and wholesale, and business services*. *Manufacturing* and *healthcare* are the least likely to deploy, though well over half (56 percent) of the most reluctant *manufacturing* respondents are, at minimum, *evaluating* the use of AI, data science, and machine learning.

Deployment of AI, Data Science, and Machine Learning by Industry

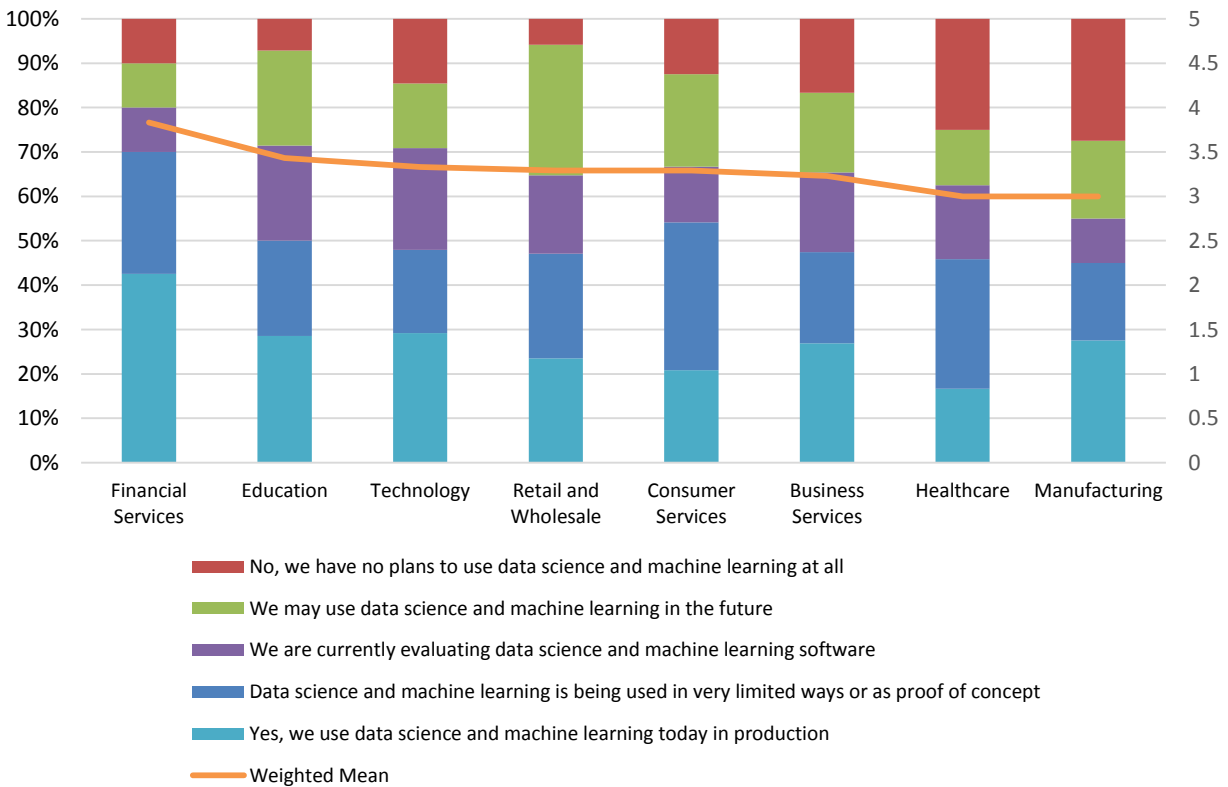


Figure 30 – Deployment of AI, data science, and machine learning by industry

2023 AI, Data Science, and Machine Learning Market Study

Deployment of AI, Data Science, and Machine Learning by Organization Size

The number of deployments of AI, data science, and machine learning clearly increases with organization size in 2023 (fig. 31). This year, 17 percent of small organizations (1-100 employees) report production deployments, compared to 18 percent at midsize (101-1,000 employees), 25 percent at large (1,001-10,000 employees), and 51 percent at very large organizations (> 10,000 employees). Combined *in production plus limited current use* is by far highest in very large (about 76 percent) and large (52 percent), organizations and falls more abruptly at smaller peers. Small and midsize organizations are most likely (44-45 percent) to say they *may use in the future* or have *no plans*.

Deployment of AI, Data Science, and Machine Learning by Organization Size

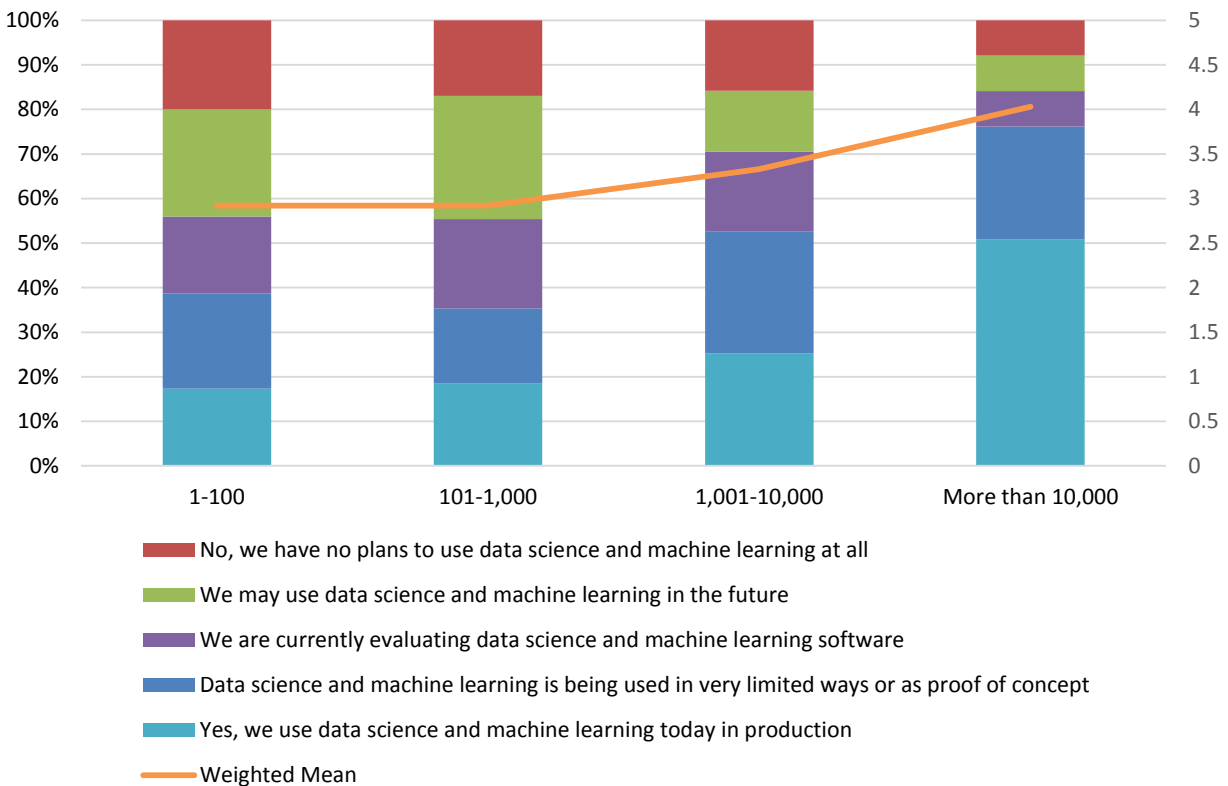


Figure 31 – Deployment of AI, data science, and machine learning by organization size

2023 AI, Data Science, and Machine Learning Market Study

Deployment of AI, Data Science, and Machine Learning by Success with BI

Deployment of AI, data science, and machine learning correlates to success with BI in 2023 (fig. 32). Organizations that say they are *completely successful* or *somewhat successful* with business intelligence are 51 and 53 percent likely to be current users of AI, data science, and machine learning, compared to 36 percent of *somewhat unsuccessful* and *unsuccessful* organizations. Conversely, organizations that are *somewhat unsuccessful* and *unsuccessful* with BI are far more likely (56 percent) to say they have *no plans* or *may use in the future*.

Deployment of AI, Data Science, and Machine Learning by Success with BI

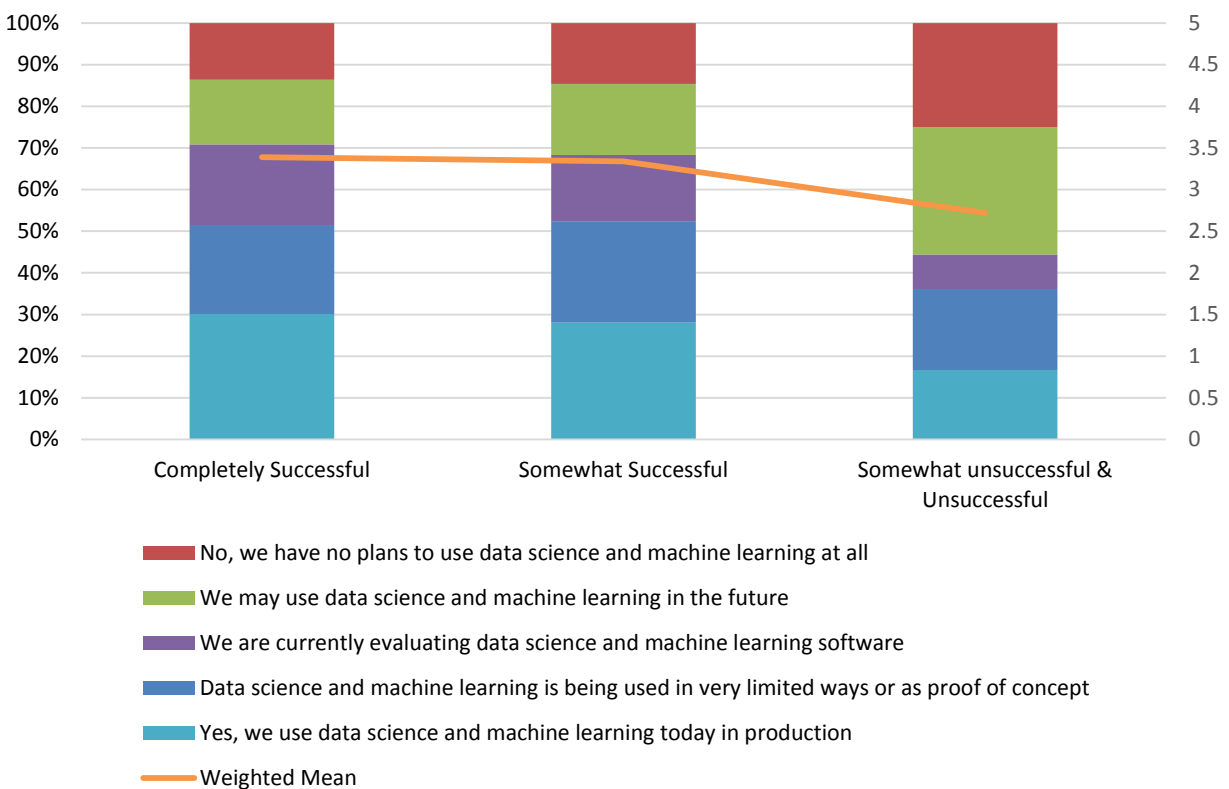


Figure 32 – Deployment of AI, data science, and machine learning by success with BI

2023 AI, Data Science, and Machine Learning Market Study

Deployment of AI, Data Science, and Machine Learning by Data Literacy

The perceived level of data literacy correlates with the likelihood of current or future deployment of AI, data science, and machine learning in 2023 (fig. 33). Organizations that report *extremely high* data literacy are 43 percent likely to be current production users, compared to 23-24 percent for *high literacy*, *moderate literacy*, and *low literacy*. The correlation is true in reverse among respondents with *no plans* or those that *may use* data science and machine learning in the future. Organizations with extremely high data literacy are just 5 percent likely to have *no plans*, compared to 15 percent at organizations with *very low* data literacy.

Deployment of AI, Data Science, and Machine Learning by Data Literacy

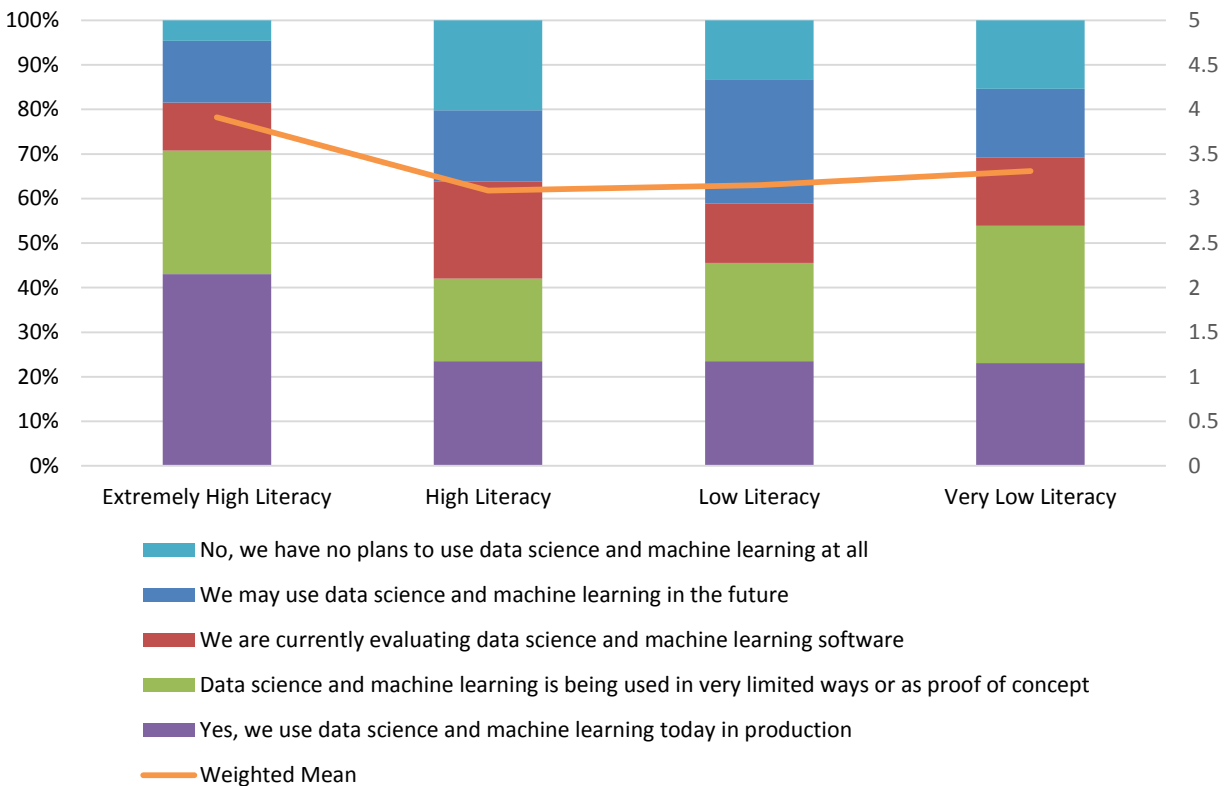


Figure 33 – Deployment of AI, data science, and machine learning by data literacy

Longevity of AI, Data Science, and Machine Learning

Longevity of AI, Data Science, and Machine Learning 2018-2023

We see indicators of AI, data science, and machine learning adoption strongly reflected in the longevity of current programs, particularly during the two most recent years (fig. 34). For example, weighted-mean longevity jumped in 2022-2023 a graduated (0-5 scale) score of 3.5-3.6, compared to 3.0 in 2021, 2.9 in 2020, and just 2.4 in 2019. The longest-extant users of data science and machine learning (more than five years) is also sharply up to about 32 percent in 2022-2023, an indicator of persistence we expect to grow in the future. While we see in total an increasing number of programs of two years or more, newer startup examples of one year or less decline in the long view and currently hover at about 10 percent in 2023.

Longevity of AI, Data Science, and Machine Learning 2018-2023

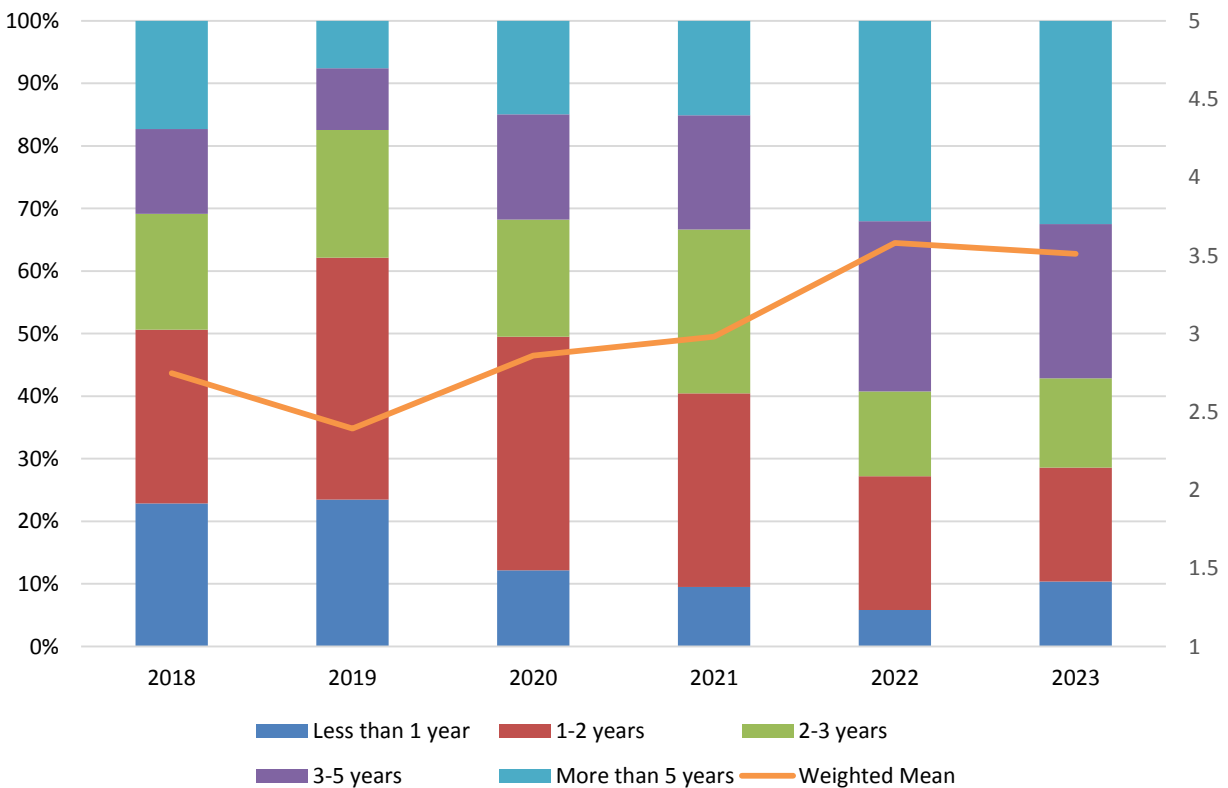


Figure 34 – Longevity of AI, data science, and machine learning 2018-2023

2023 AI, Data Science, and Machine Learning Market Study

Longevity of AI, Data Science, and Machine Learning by Geography

Viewed by geographic region, the longevity of AI, data science, and machine learning is highest in EMEA, followed by Asia Pacific and North America (fig. 35). An interesting observation in this view is that while the percentages of “oldest” users (> 5 years) are not widely different in EMEA (35 percent), versus Asia Pacific (33 percent), and North America (31 percent), we observe much more startup activity of two years or less in North America (36 percent), and Asia Pacific (29 percent), compared to EMEA (15 percent). While this chart does not account for actual total numbers of users reporting by region, we can conclude that North America and Asia Pacific account for most recent uptakes of AI, data science and machine learning by percentage.

Longevity of AI, Data Science, and Machine Learning by Geography

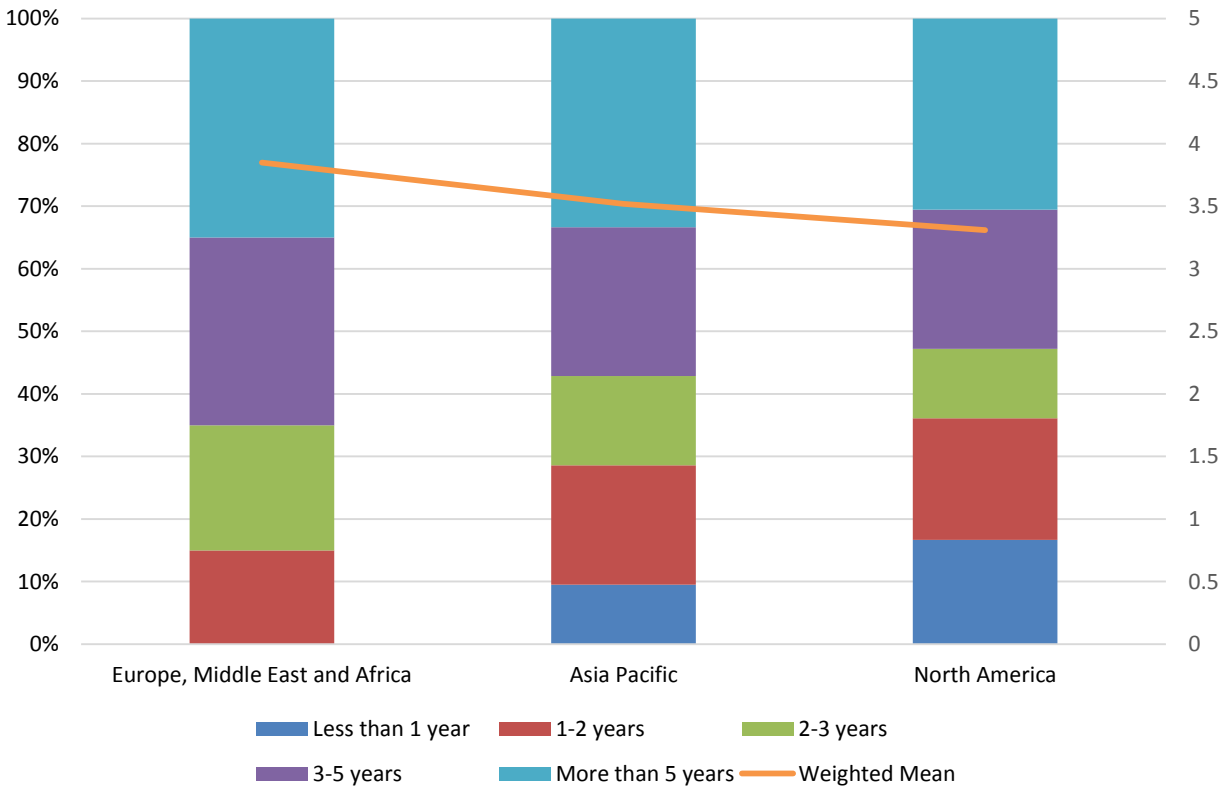


Figure 35 – Longevity of data science and machine learning by geography

Longevity of AI, Data Science, and Machine Learning by Function

The longevity of data science and machine learning efforts varies by function in 2023, often by a considerable margin (fig. 36). Expectedly, *BICC* respondents report the most mature programs overall, with 50 percent of five years or more longevity and 75 percent with three years or more. Other functions reporting higher-than-average initiatives of more than three years include *executive management* (60 percent) and *operations* (58 percent). At the other end of the spectrum, just 20 percent of *finance* respondents report programs of more than three years. This distribution takes a similar but more dramatic path compared to deployment by function (fig. 29) or by importance by function (fig. 15).

Longevity of AI, Data Science, and Machine Learning by Function

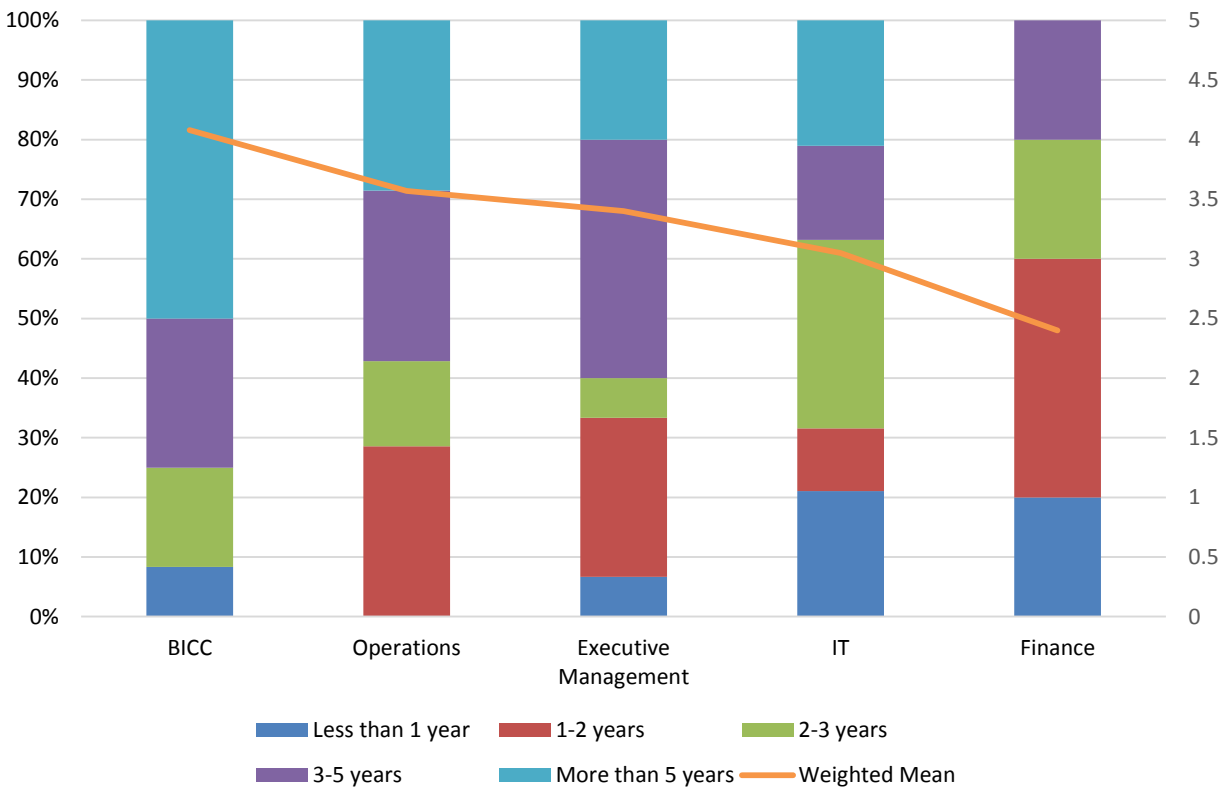


Figure 36 – Longevity of AI, data science, and machine learning by function

2023 AI, Data Science, and Machine Learning Market Study

Longevity of AI, Data Science, and Machine Learning by Industry

Viewed by industry, *financial services* and *technology* respondents give the highest weighted-mean score (3.8, or close to *very important*) for longevity of AI, data science, and machine learning (fig. 37). *Financial services* respondents also report the most mature use of more than five years (47 percent) in 2023, while *technology* respondents report the greatest longevity of more than three years (71 percent). *Business services*' weighted mean is next highest at 3.5, with greater than 30 percent of programs of five years or longer. *Manufacturing* respondents clearly trail other industries in this view, possibly in relation to the number of currently applicable use cases and their emerging importance (fig. 19).

Longevity of AI, Data Science, and Machine Learning by Industry

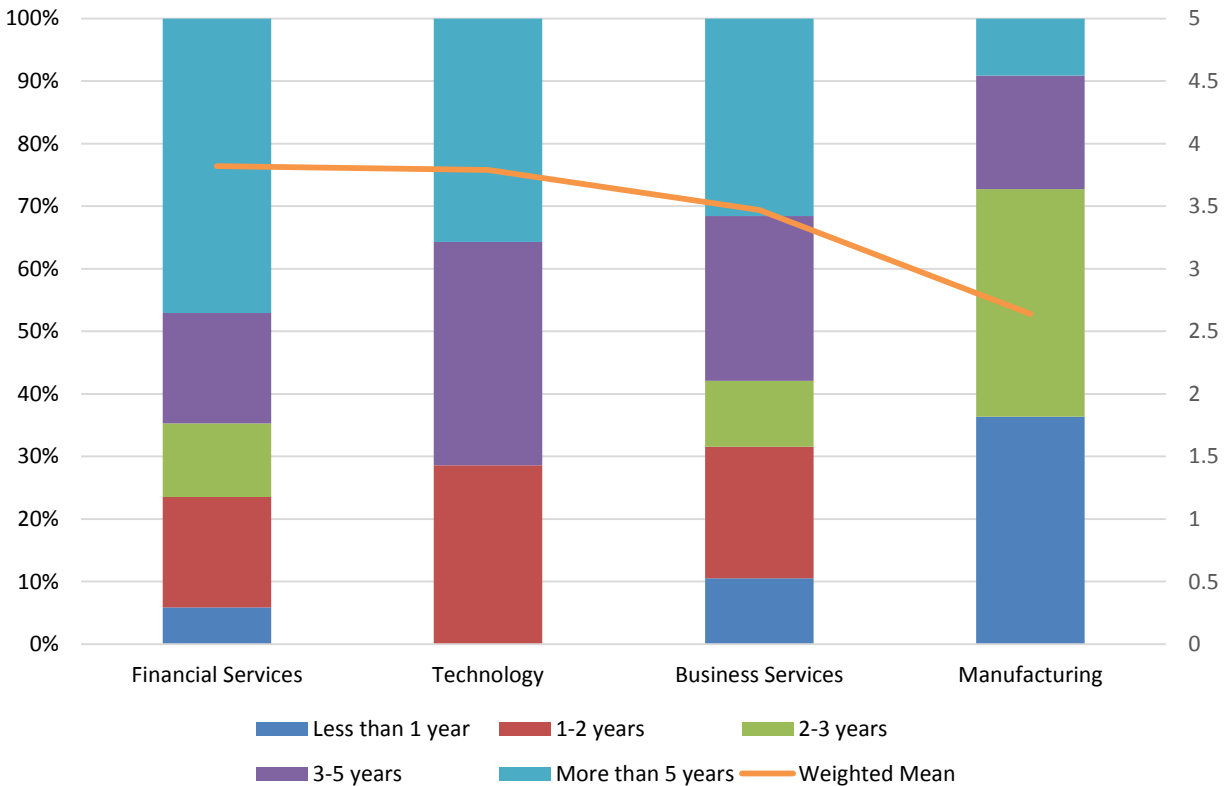


Figure 37 – Longevity of AI, data science, and machine learning by industry

2023 AI, Data Science, and Machine Learning Market Study

Longevity of AI, Data Science, and Machine Learning by Organization Size

The longevity of the use of AI, data science, and machine learning tends to increase with organization size in 2023 (fig. 38). This finding is well borne out in the distinction between small organizations (1-100 employees) and very large organizations (> 10,000 employees), (where weighted-mean differences are greatest), but it is not a universal relationship. This year, midsize organizations (101-1,000 employees) report the greatest percentage of programs of five years or longer (55 percent), followed by very large organizations (41 percent). Also, we observe more new activity in startup programs of one year or less at small (15 percent) and midsize (18 percent) organizations, compared to larger peers (7-9 percent).

Longevity of AI, Data Science, and Machine Learning by Organization Size

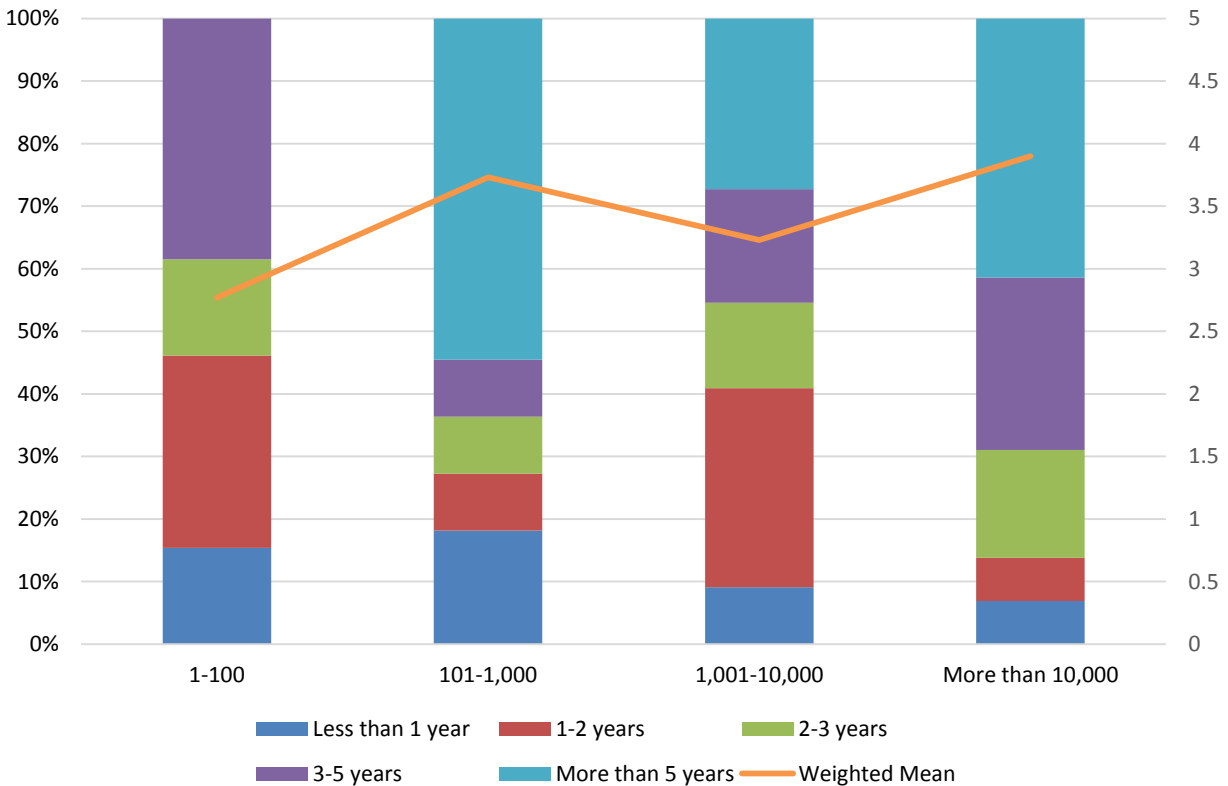


Figure 38 – Longevity of AI, data science, and machine learning by organization size

Feature for AI, Data Science and Machine Learning

Respondents express significant interest in the full range of feature requirements for AI, data science, and machine learning in 2023, where all but one of 23 sampled features are at least *important* to 60 percent or more respondents (fig. 39). The most popular among these support traditional statistical methods: *outlier detection*, *range of regression models*, *optimization (e.g., linear programming)*, *cross correlation analysis*, and *model explain-ability*. All these top features are at least *very important* to 48-56 percent of respondents. (Also see industry support for features, fig. 71.)

Features for AI, Data Science, and Machine Learning

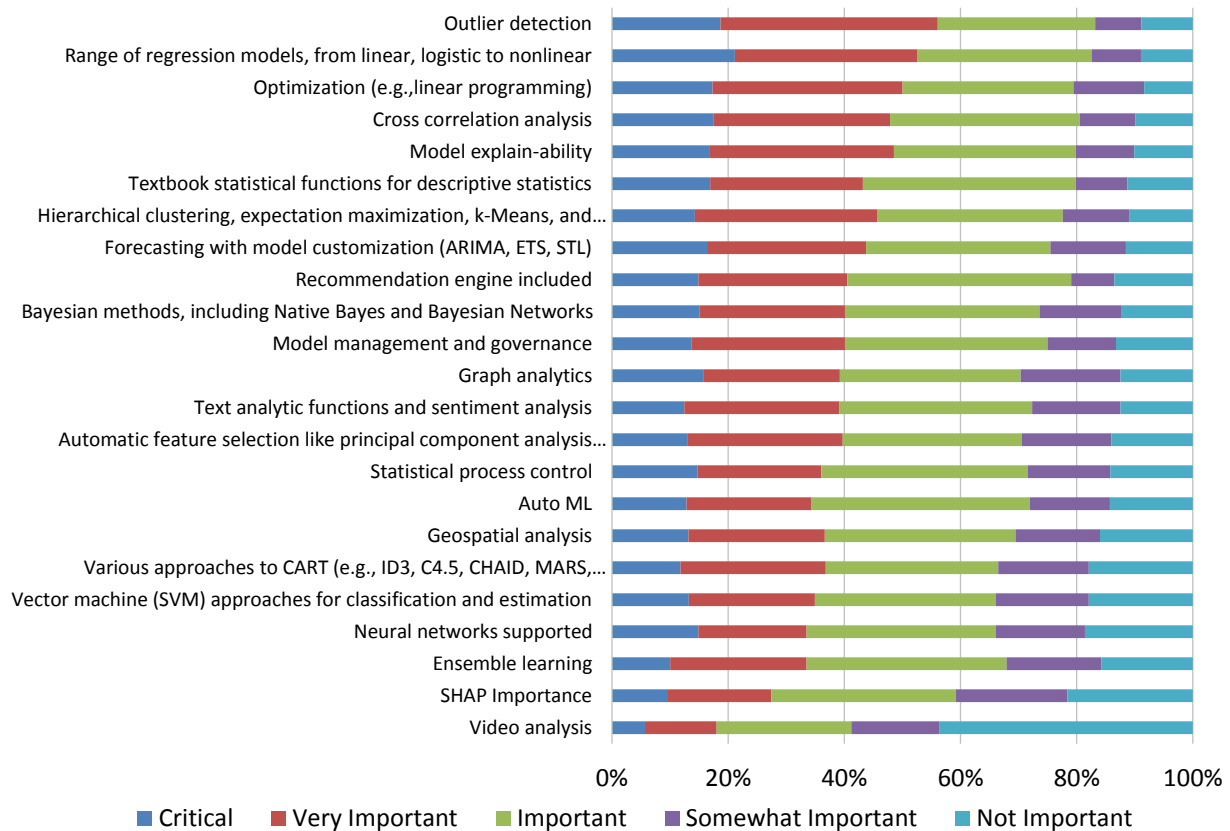


Figure 39 – Features for AI, data science, and machine learning

2023 AI, Data Science, and Machine Learning Market Study

Features for AI, Data Science, and Machine learning 2014-2023

Fig. 40 shows respondent interest in feature requirements for AI, data science, and machine learning across 10 years of our data collection. Amid ebbs and flows, we observe 2023 interest near a historical average level, with no all-time highs of interest (many of which were reached in our 2022 study). Even so, this view of feature importance over time shows strong growth since our inaugural 2014 study and sustained relevance of nearly all features at or above the value signifying *important*.

Features for AI, Data Science, and Machine Learning 2014-2023

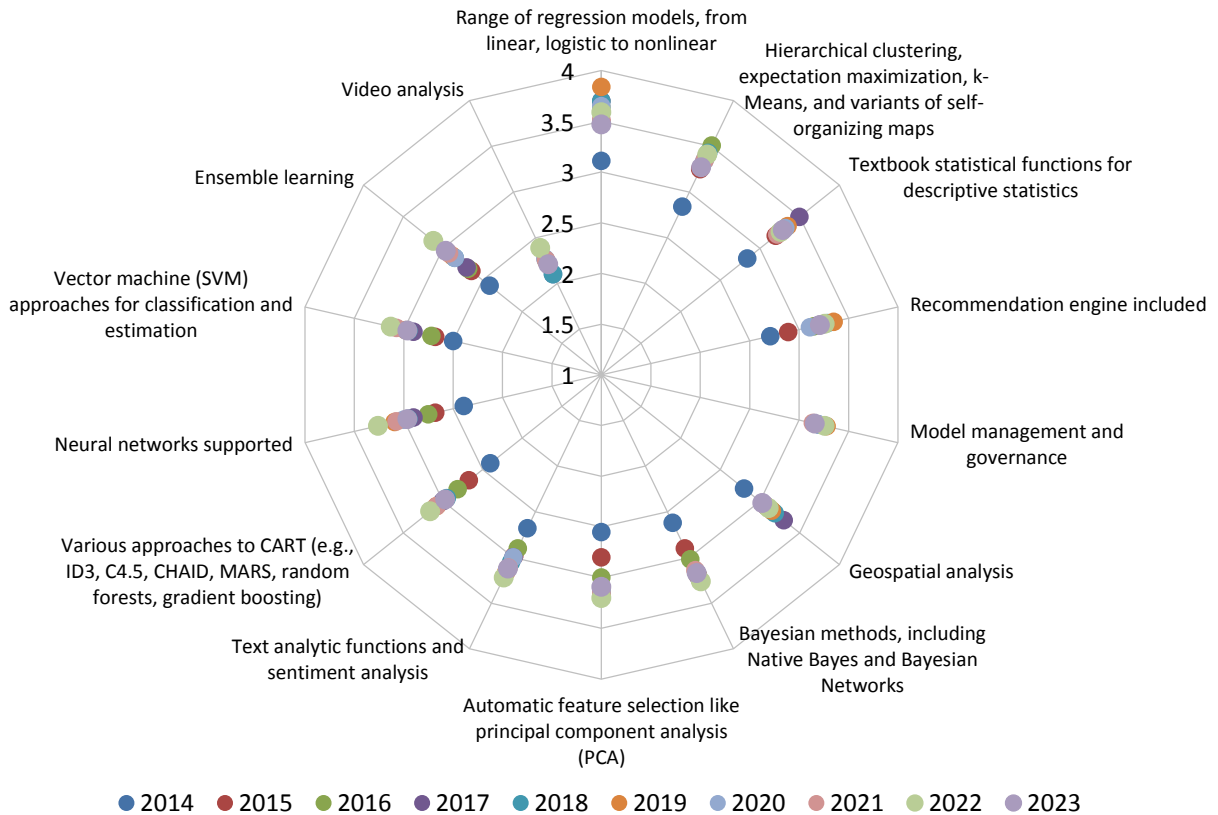


Figure 40 – Features for AI, data science, and machine learning 2014-2023

2023 AI, Data Science, and Machine Learning Market Study

Features for AI, Data Science, and Machine learning by Geography

In 2023, Asia Pacific respondents report the highest scores for all features addressing AI, data science, and machine learning, often by wide margins (fig. 41). Several features have close to *very important* relevance in Asia Pacific, including *outlier detection*, *range of regression models*, *model management and governance*, and *statistical process control*. Importance scores are second highest among EMEA respondents, with nearly all features at or above a level signifying *important*. North America scores are nearly always lowest by comparison, though a majority of features receive scores of at least *important*.

Features for AI, Data Science, and Machine Learning by Geography

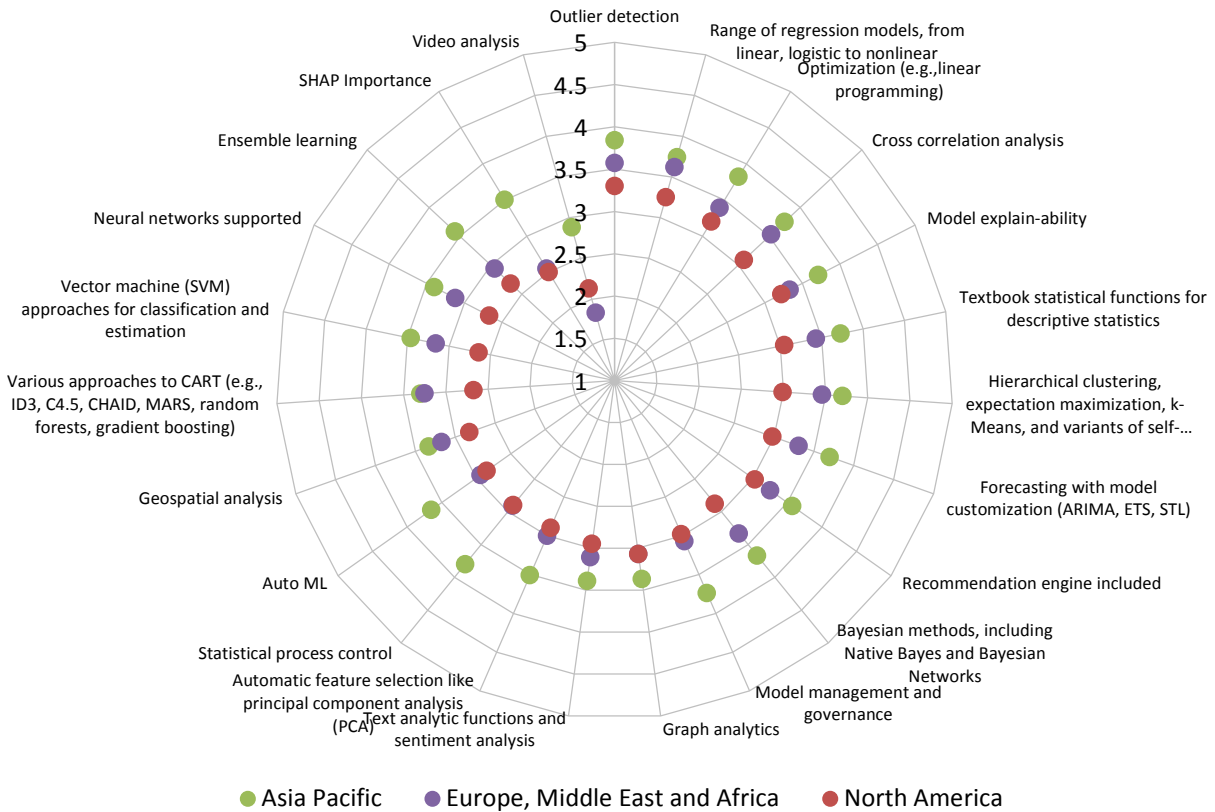


Figure 41 – Features for AI, data science, and machine learning by geography

2023 AI, Data Science, and Machine Learning Market Study

Features for AI, Data Science, and Machine learning by Function

Viewed by function, *BICC* respondents dramatically dominate interest in features for AI, data science, and machine learning in 2023 (fig. 42). Historically, *BICC* leadership is often a sign of current or incipient uptake of enterprise technology. Within this group, many features have near or greater than *very important* relevance, including *cross correlation analysis*, *model explain-ability*, *forecasting with model customization*, and *text analytic functions and sentiment analysis*. Excluding *BICC*, we observe several areas of discrete functional interest. For example, *operations* reports relatively high interest in *range of regression models* and *hierarchical clustering*. Separately, *sales and marketing* give high scores to *optimization*, *forecasting with model customization*, and *graph analytics*.

Features for AI, Data Science, and Machine Learning by Function

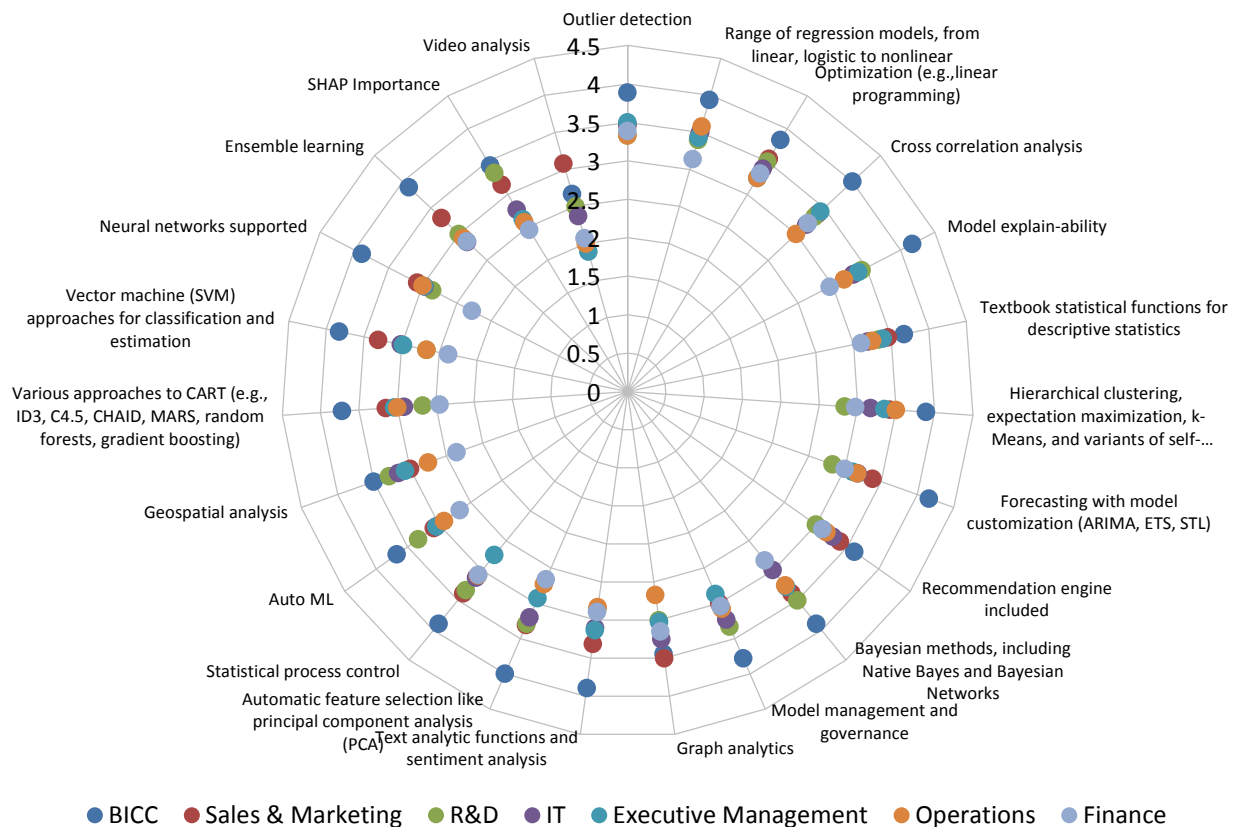


Figure 42 – Features for AI, data science and machine learning by function

2023 AI, Data Science, and Machine Learning Market Study

Features for AI, Data Science, and Machine learning by Industry

Interest in features for AI, data science, and machine learning varies selectively by industry in 2023, with a mix of high and low interests (fig. 43). This year, for example, respondents in *technology* are among the leading proponents in several categories, including *outlier detection*, *range of regression models*, *model explain-ability*, *forecasting with model customization*, *recommendation engine*, *model management and governance*, *auto ML*, and more. *Retail and wholesale* also highly favors *range of regression models*, *recommendation engine*, *text analytic functions and sentiment analysis*, and *various approaches to CART* but gives below-average scores to many other areas. Overall, the top 10 features receive scores of at least *important* from nearly every industry.

Features for AI, Data Science, and Machine Learning by Industry

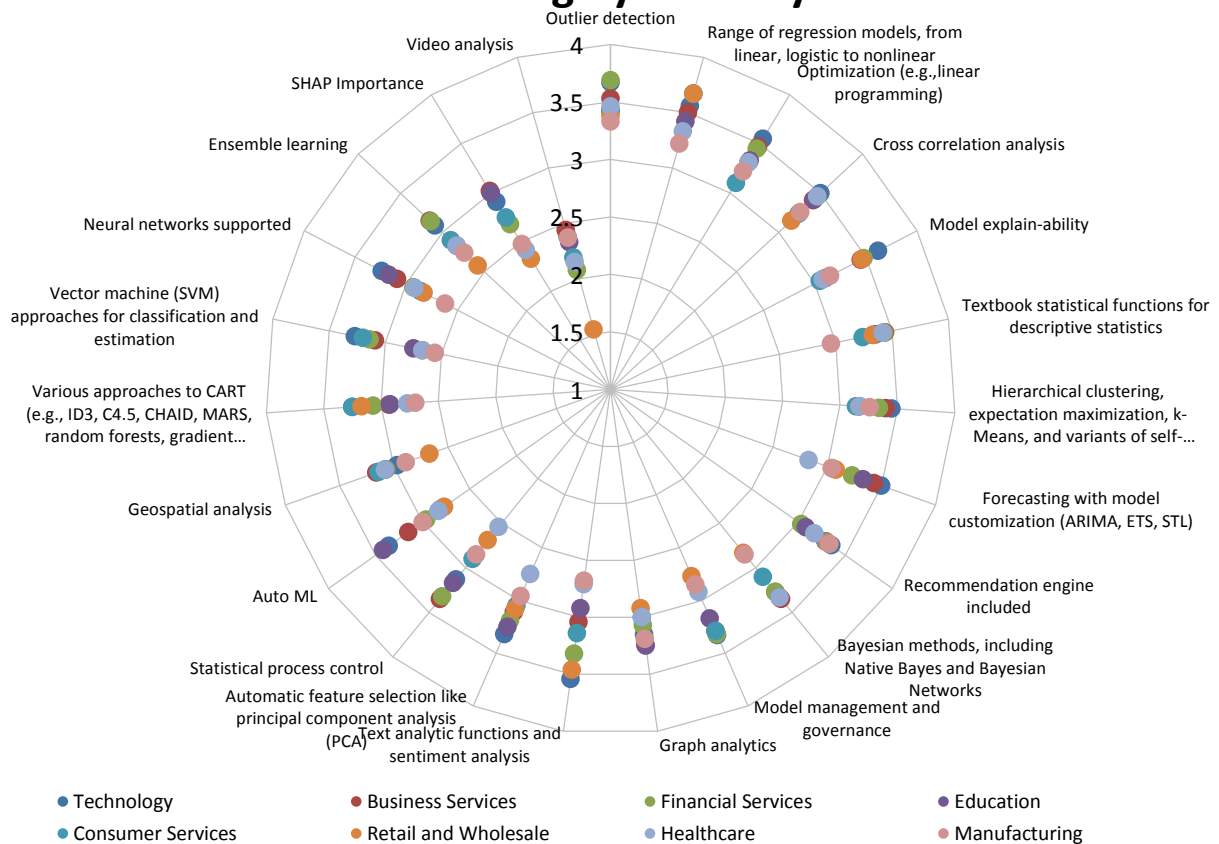


Figure 43 – Features for AI, data science, and machine learning by industry

2023 AI, Data Science, and Machine Learning Market Study

Features for AI, Data Science, and Machine learning by Organization Size

Interest in analytical features for AI, data science, and machine learning consistently correlates with increasing organization size in 2023 (fig. 44). Indeed, very large organizations (> 10,000 employees) lead interest in every feature we sampled this year, with some features, including *range of regression models*, *optimization*, and *model management and governance* at or approaching the level signifying *very important*. The second-highest interest is likewise in large organizations (1,001-10,000 employees) for all features we sampled. As we sometimes observe, small organization (1-100 employees) interest outstrips some larger peers, particularly those in midsize organizations (101-1,000 employees). This year, the top 14 features all receive scores of at least *important* in all but midsize organizations.

Features for AI, AI, Data Science, and Machine Learning by Organization Size

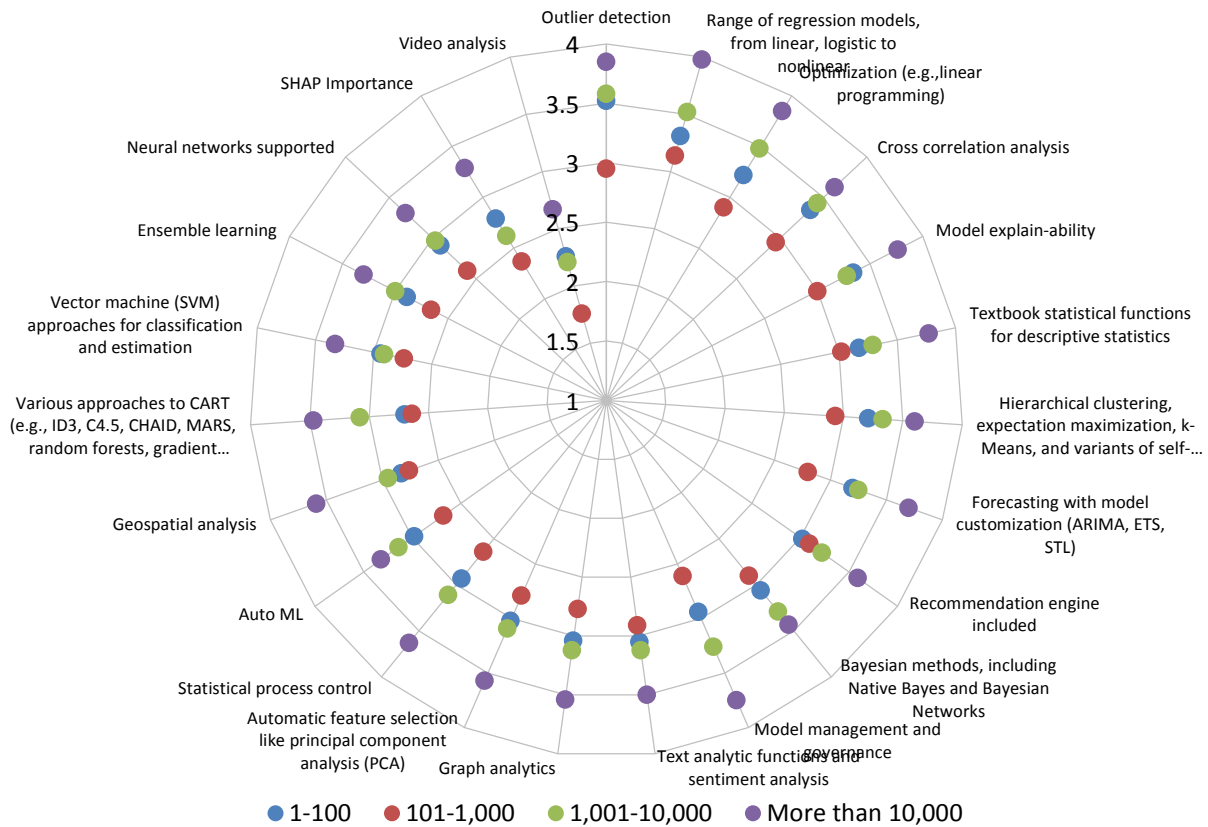


Figure 44 – Features for AI, data science, and machine learning by organization size

2023 AI, Data Science, and Machine Learning Market Study

Data-Preparation Plans for AI, Data Science, and Machine Learning

Our study addresses a detailed set of 16 data-preparation capabilities that support AI, data science, and machine learning (figs. 45-47).

All 16 data-preparation features earn very respectable attention in 2023 (fig. 45). Features with the highest *critical* or *very important* importance (about 60 percent or greater) this year include *cleansing and enrichment of source data*, *detecting duplicates or outliers*, *set operations*, *complex filtering*, and *data lineage, profiling and quality*. A second tier of importance includes features for *data flows for multi-step transformations*; *support for cutting, merging, and replacing values*; and *formula scripting*. In total, all features are *critical* or *very important* to about 40 percent or far more respondents, and all are at least *important* to more than 70 percent. (Also see industry support, fig. 74.)

Data Preparation for AI, Data Science, and Machine Learning

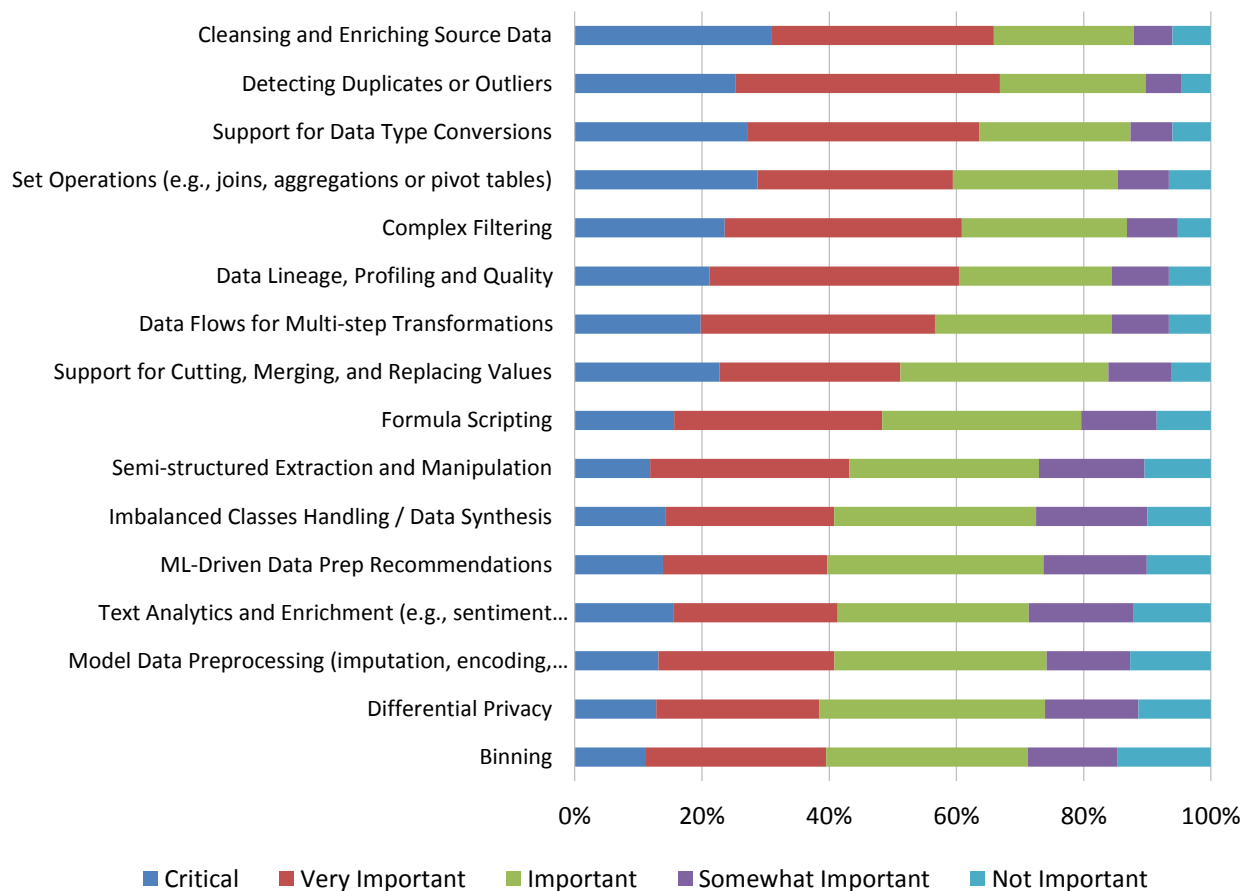


Figure 45 – Data preparation for AI, data science, and machine learning

2023 AI, Data Science, and Machine Learning Market Study

Data Preparation for AI, Data Science, and Machine Learning by Industry

Interest in data preparation for AI, data science and machine learning distributes inconsistently across vertical industries, often with wide variations by feature (fig. 46). Features that receive scores of at least *very important* in 2023 include *cleansing and enriching of data sources* and *support for data type conversions* in *business services*; *detecting duplicates or outliers* in the case of *retail and wholesale*; *set operations* in *financial services* and *business services*; and *data lineage, profiling and quality*, also in the case of *financial services*. Feature interest varies by average by industry as well. For example, *technology* organizations give above-average overall scores to most features, while *manufacturing* organizations lag in interest in most feature categories.

Data Preparation for AI, Data Science, and Machine Learning by Industry

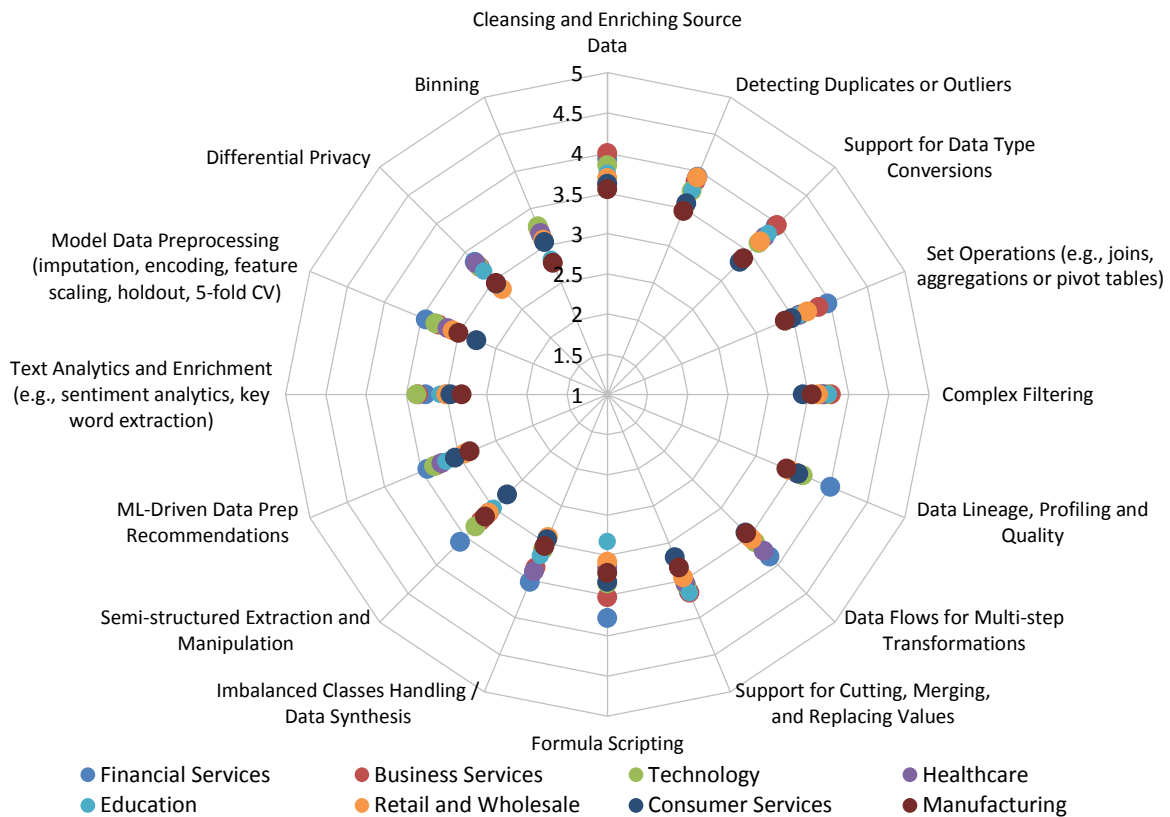


Figure 46 – Data preparation for AI, data science, and machine learning by industry

2023 AI, Data Science, and Machine Learning Market Study

Data Preparation for AI, Data Science, and Machine Learning by Organization Size

In 2023, very large organizations (>10,000 employees) and large organizations (1,001-10,000 employees) give the highest score for all data-prep features (fig. 47). In nearly every case, interest in data-prep features declines with global headcount among respondents from very large, to large, to small or midsize organizations. That said, interest in the majority of 16 sampled data-preparation capabilities is always above 3.0 (*important*) to all organizations of different sizes.

Data Preparation for AI, Data Science, and Machine Learning by Organization Size

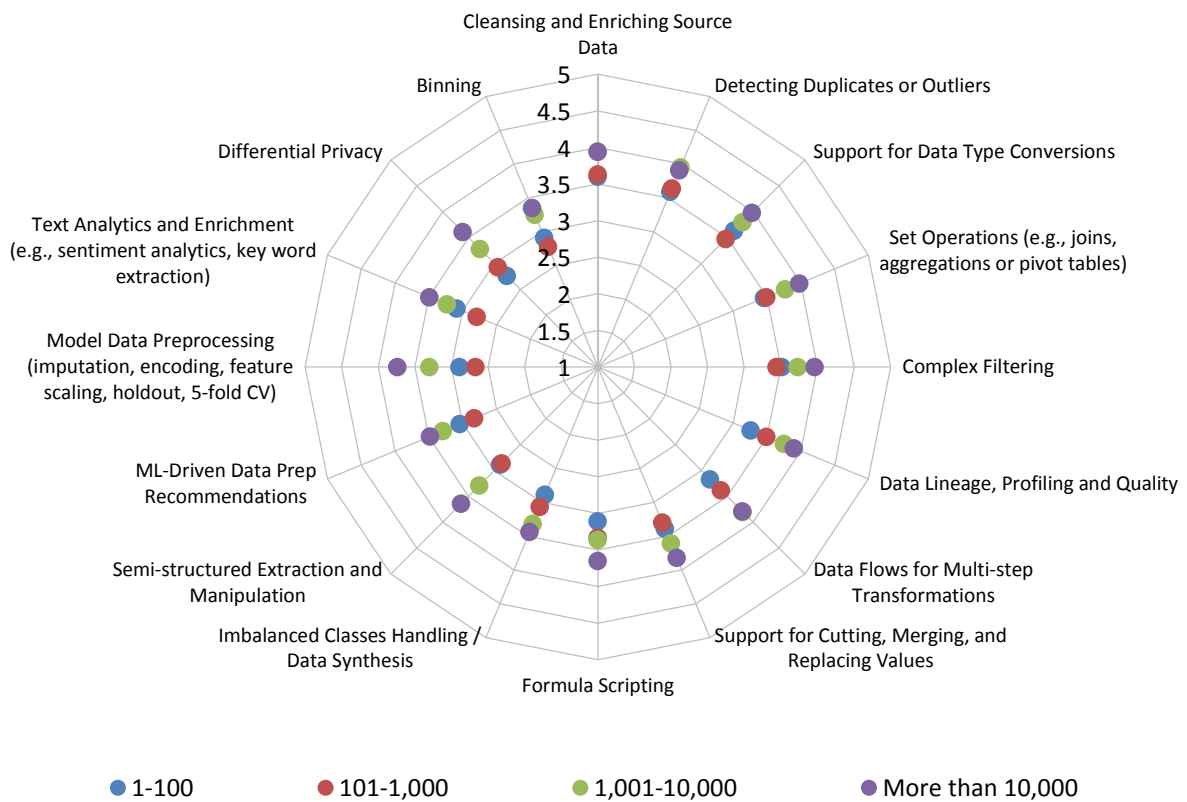


Figure 47 – Data preparation for AI, data science, and machine learning by organization size

2023 AI, Data Science, and Machine Learning Market Study

Usability for AI, Data Science, and Machine Learning

Our study addresses a detailed set of 16 usability benefits that support AI, data science, and machine learning activities and processes (figs. 48-52).

Usability features generally address process or activity simplification and automation and, without exception, respondents give them high importance scores. All 16 2023 criteria we sample are, at minimum, *important* to close to 70 percent or far more respondents (fig. 48). The top five features (*access to advanced analytics, support for easy iteration, support/guidance in preparing analytical models, fast cycle time for analysis with data preparation functions, and simple process for continuous modification of models*) are *critical* or *very important* to between 50-57 percent of respondents. Even at the bottom of this list, *guided user experience* is still at least *somewhat important* to almost 90 percent of respondents (also see industry support for usability tools, fig. 75).

Usability for AI, Data Science, and Machine Learning

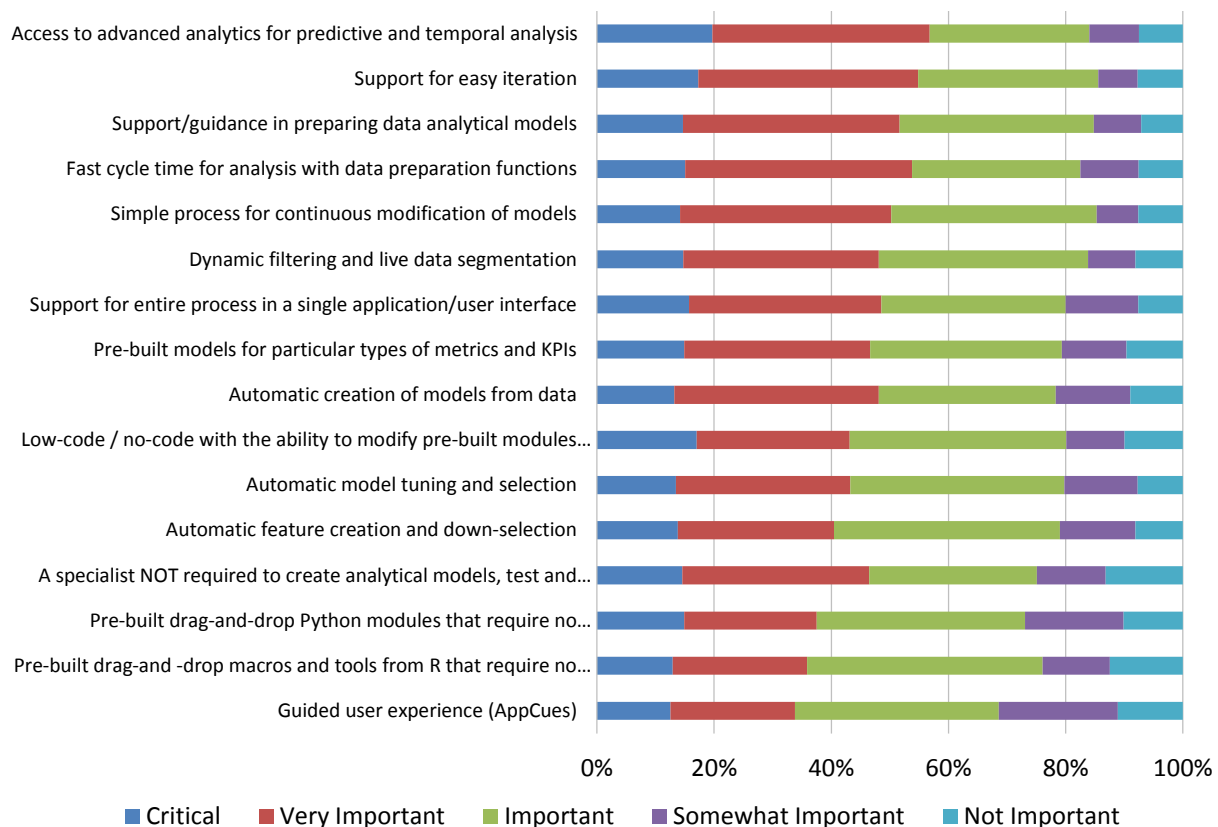


Figure 48 – Usability for AI, data science, and machine learning

2023 AI, Data Science, and Machine Learning Market Study

Usability of AI, Data Science, and Machine Learning 2018-2023

Compared to peak interest seen in 2018-2019, sentiment toward nearly all usability features for AI, data science, and machine learning declines from 2020 to 2023, albeit on a compressed scale (fig. 49). We might attribute some declines in urgency a result of greater awareness and improvements to usability features. Across the last six years of data, the perceived importance of usability features for the most part holds value or increases from 2014-2019 before falling in 2020-2023. This year, the most sustained interest is in *dynamic filtering and live data segmentation* and *specialist not required*. Within the confines of this trend, we observe all usability features remain above the level of *important* to respondents.

Usability for AI, Data Science, and Machine Learning 2018-2023

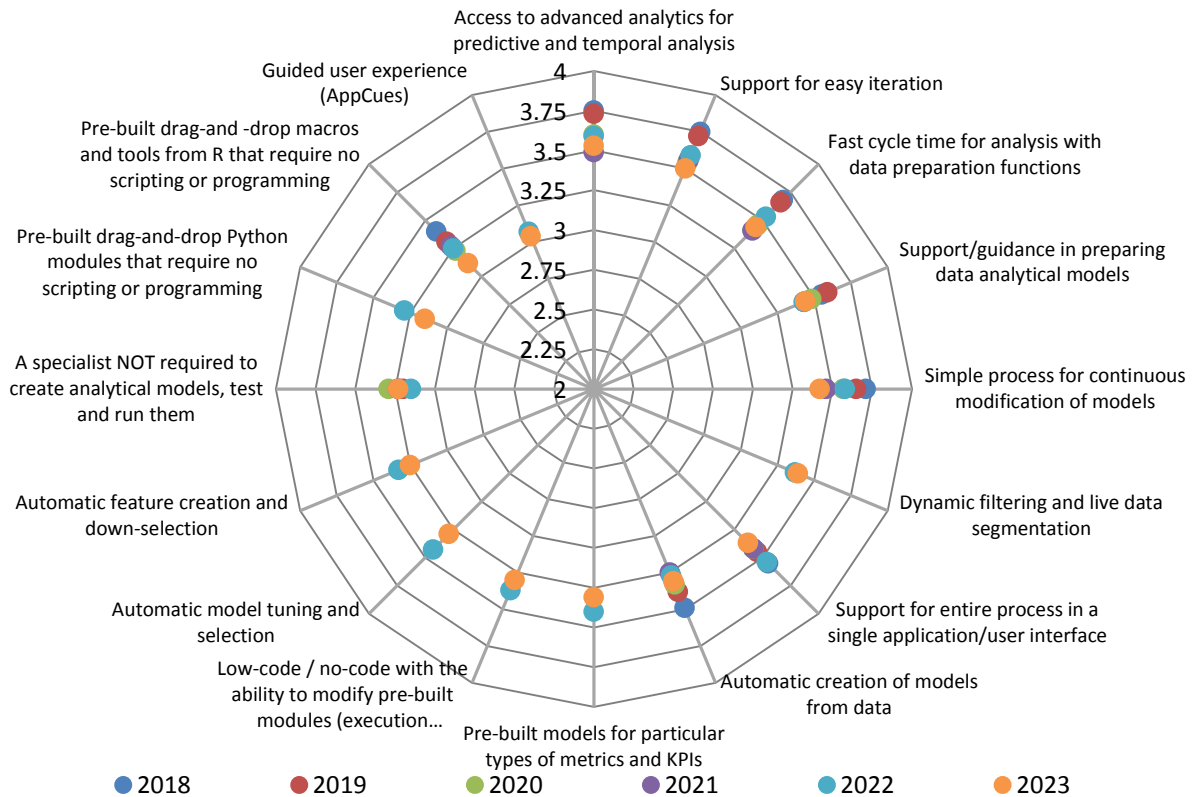


Figure 49 – Usability for AI, data science, and machine learning 2018-2023

Usability of AI, Data Science, and Machine Learning by Geography

The perceived importance of usability features for AI, data science, and machine learning in 2022 varies by geography, with interest that is always highest in Asia Pacific organizations and most often lowest in EMEA (fig. 50). Even so, the great majority of scores for most features are above the level of *important* in all geographies. The most common interest (tightest clustering) across all geographies is for *access to advanced analytics for predictive and temporal analysis* and *support/guidance in preparing data analytical models*.

Usability for AI, Data Science, and Machine Learning by Geography

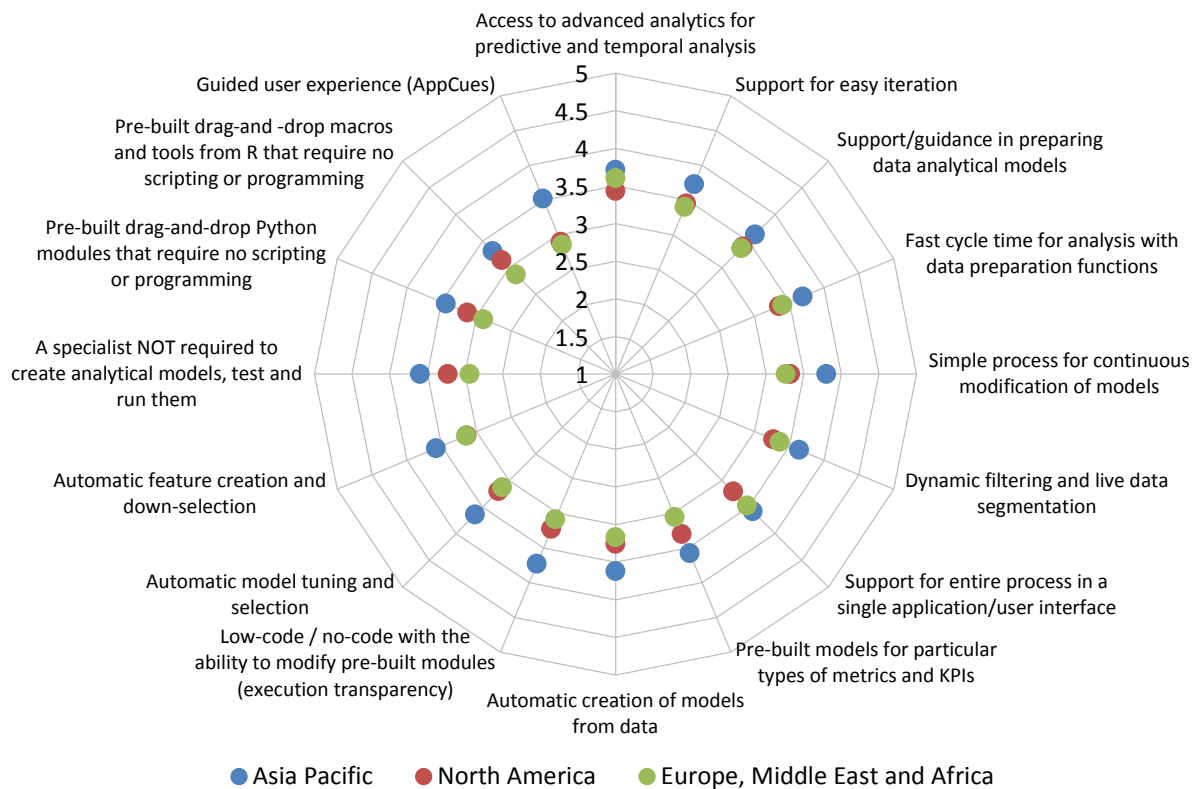


Figure 50 – Usability for AI, data science, and machine learning by geography

2023 AI, Data Science, and Machine Learning Market Study

Usability of AI, Data Science, and Machine Learning by Function

Viewed by function, combined R&D and BICC interest suggests an exploratory/iterative interest in AI, data science, and machine learning in 2023. Respondents in the *BICC* lead or share the highest interest in most usability features for AI, data science, and machine learning, including all eight of the top choices and several lesser ones, led by *access to advanced analytics for predictive and temporal analysis*, *support for easy iteration*, and *support/guidance in preparing data analytical models* (fig. 51). *R&D* respondents share high interest in *support for easy iteration*, *fast cycle times*, *low code / no code*, *pre-built drag-and-drop macros*, and *guided user experience*. *Operations* reports average or higher interest in most feature categories, while *executive management* and *finance* are most often the least interested by function.

Usability for AI, Data Science, and Machine Learning by Function

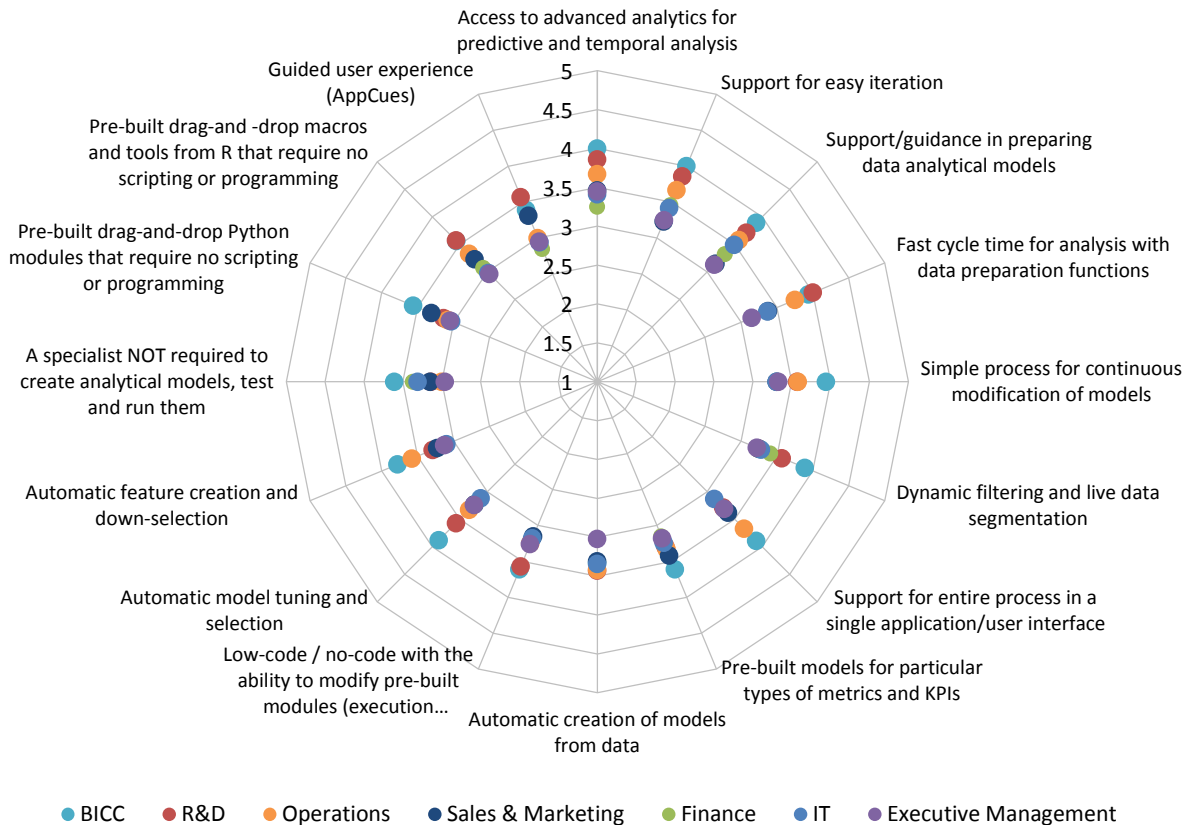


Figure 51 – Usability for AI, data science, and machine learning by function

Usability of AI, Data Science, and Machine Learning by Organization Size

Interest in usability features for AI, data science, and machine learning increases with global headcount to an observable if not dramatic degree (fig. 52). In nearly every case, interest in features is highest at very large organizations (>10,000 employees), typically followed by large organizations (1,001-10,000 employees). As we often observe, small organization (1-100 employees) interest is selectively higher than that of midsize (101-1,000 employees) peers. This is particularly the case for *support/guidance in preparing data analytical models*, *low code / no code*, and *automatic creation of models for data*. All scores for all features among all enterprises are at or above the level of *important*.

Usability for AI, Data Science, and Machine Learning by Organization Size

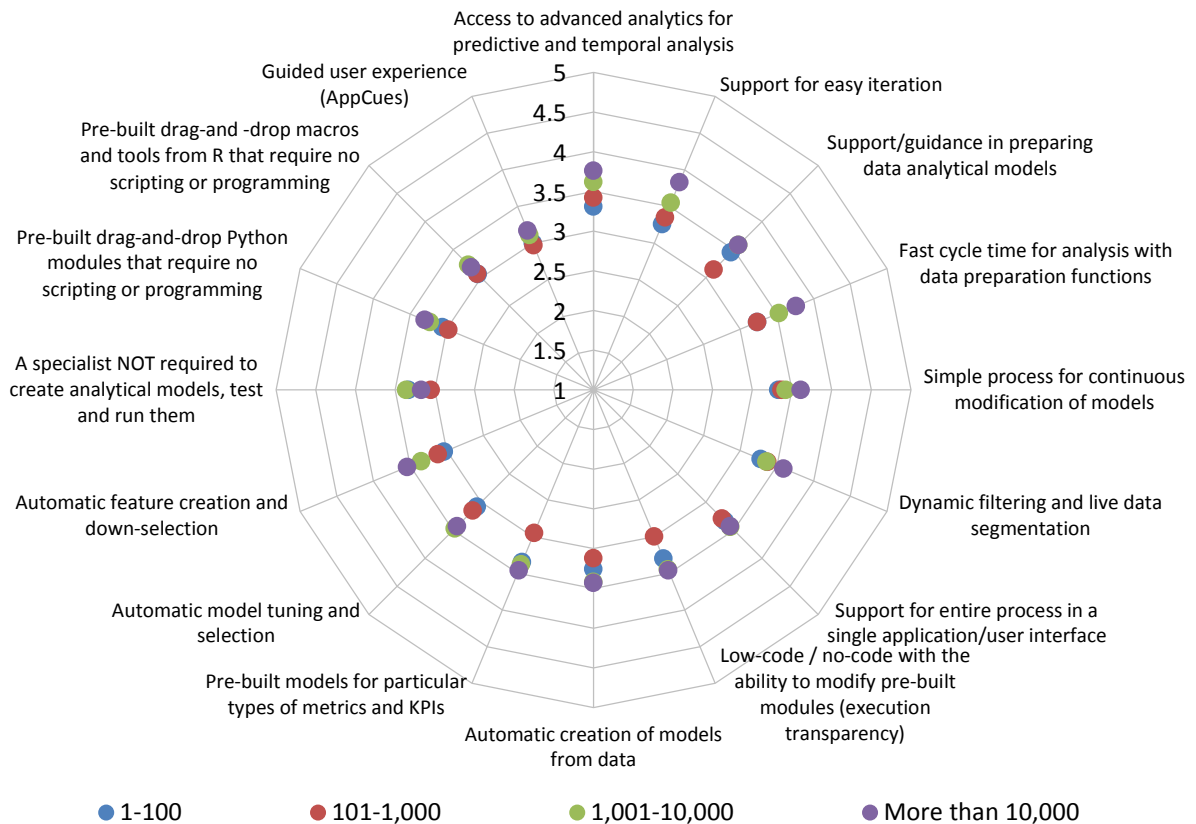


Figure 52 – Usability for AI, data science, and machine learning by organization size

Scalability of Data Science and Machine Learning

Our study addresses respondents' interest in a set of scalability technologies and architectures that support AI, data science, and machine learning (figs. 53-56). All 11 sampled features are at least *important* to close to half or far more (up to 83 percent) of respondents in 2023 (fig. 53). This year (like last year), two features, *in-database analytics* and *in-memory analytics*, are clearly the most important, after which interest declines somewhat in a second tier led by *multi-tenant cloud services*, *horizontal scaling*, *code generation supported*, *GPU acceleration*, and *hybrid / cloud bursting*. (Also see industry support for scalability, fig. 76.)

Scalability for AI, Data Science, and Machine Learning

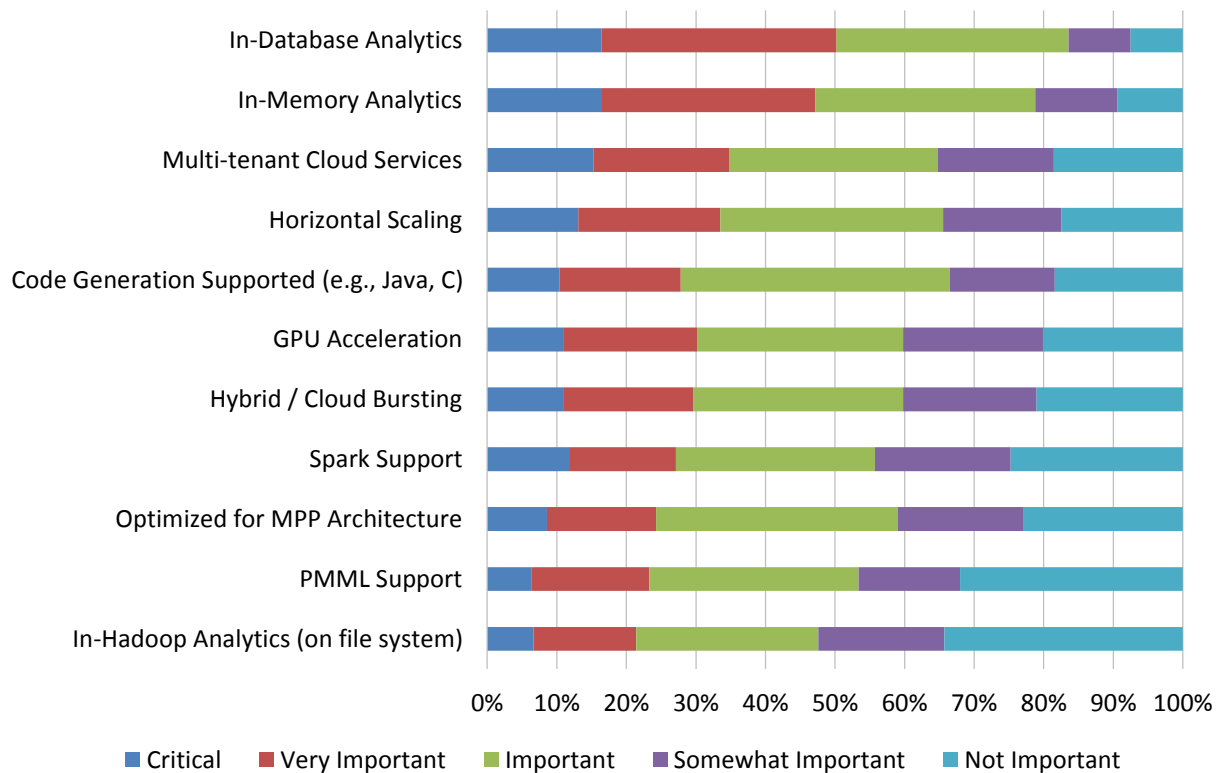


Figure 53 – Scalability for AI, data science and machine learning

2023 AI, Data Science, and Machine Learning Market Study

Scalability for AI, Data Science, and Machine Learning 2021-2023

Sentiment toward the 11 scalability features for AI, data science, and machine learning studied since 2018 was somewhat flat through the last three-year history of findings, with only minor variations in 2023 (fig. 54). This year, year-over-year sentiment increases slightly for *horizontal scaling*, *multi-tenant cloud services*, and *code generation supported*. The remaining scalability features decline in importance, albeit very slightly, including top-ranked *in-memory analytics* and *in-database analytics*. The latter two features are the only ones to register above the level of *important* in all the three most recent years.

Scalability for AI, Data Science, and Machine Learning 2021-2023

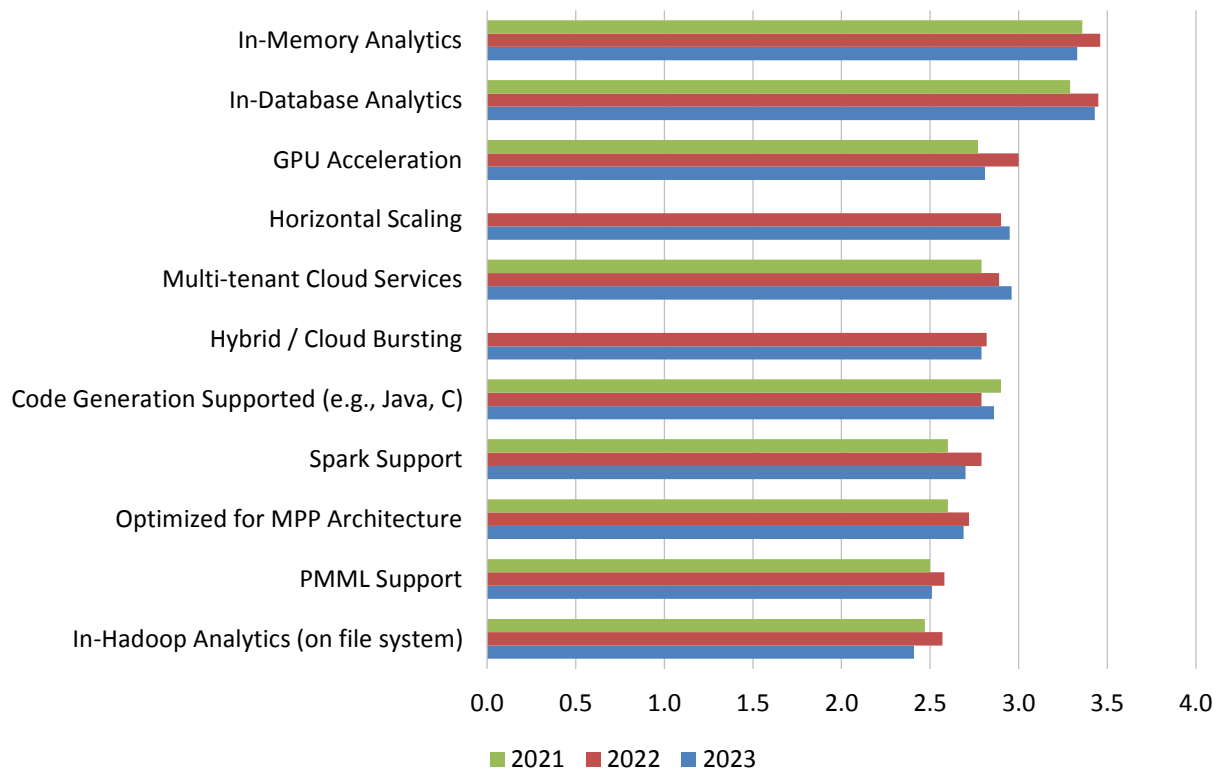


Figure 54 – Scalability of data science and machine learning 2021-2023

Scalability for AI, Data Science, and Machine Learning by Function

Interest in scalability features for AI, data science, and machine learning is most often highest among *BICC*, *R&D*, *IT*, and *operations* respondents, a mix that implies high development/deployment interest and/or incipient demand (fig. 55). In 2023, the top two features, *in-memory analytics* and *in-database analytics*, receive the highest scores overall from *BICC* respondents, which also top interest in *horizontal scaling* and *PMML support*. *R&D* reports the highest or near-highest importance in several categories including *multi-tenant cloud services*, *code generation supported*, *GPU acceleration*, and *hybrid / cloud bursting*. *IT* likewise scores near the top for many scalability features. *Operations* reports high scores for *multi-tenant cloud services*, *Spark support*, *optimized for MPP architecture*, and *in-Hadoop analytics*. Interest is usually lowest among *executive management* and *finance* respondents.

Scalability for AI, Data Science, and Machine Learning by Function

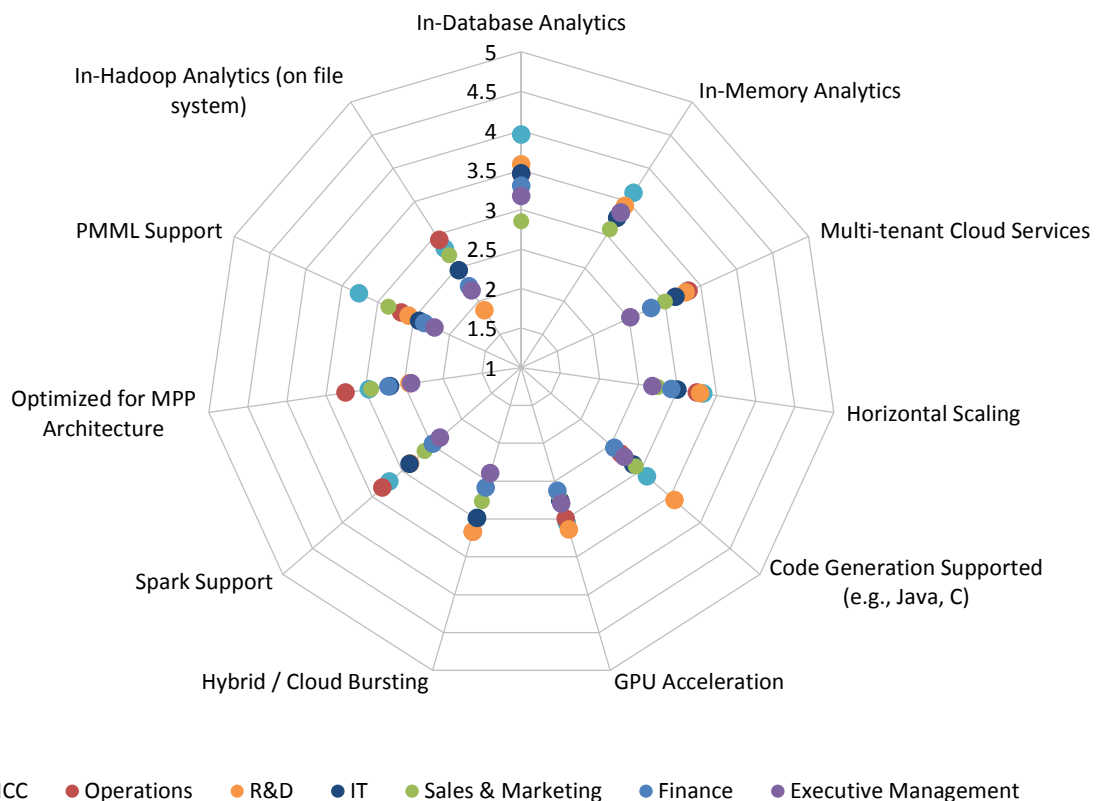


Figure 55 – Scalability of data science and machine learning by function

2023 AI, Data Science, and Machine Learning Market Study

Scalability for AI, Data Science, and Machine Learning by Organization Size

In 2023 (and in earlier studies), interest in scalability capabilities for data science and machine learning correlates strongly to global headcount (fig. 56). Very large organizations (> 10,000 employees) lead all but one category (the exception being *in-memory analytics*, narrowly led by large organizations), often by a significantly wide margin. The top two categories, *in-database analytics* and *in-memory analytics*, are the areas of greatest universal interest across organizations of any size. In all but the aforementioned case, interest is second-highest in large organizations (1,001-10,000 employees), followed by either midsize (101-1,000 employees) or small (1-100 employees) organizations.

Scalability for AI, Data Science, and Machine Learning by Organization Size

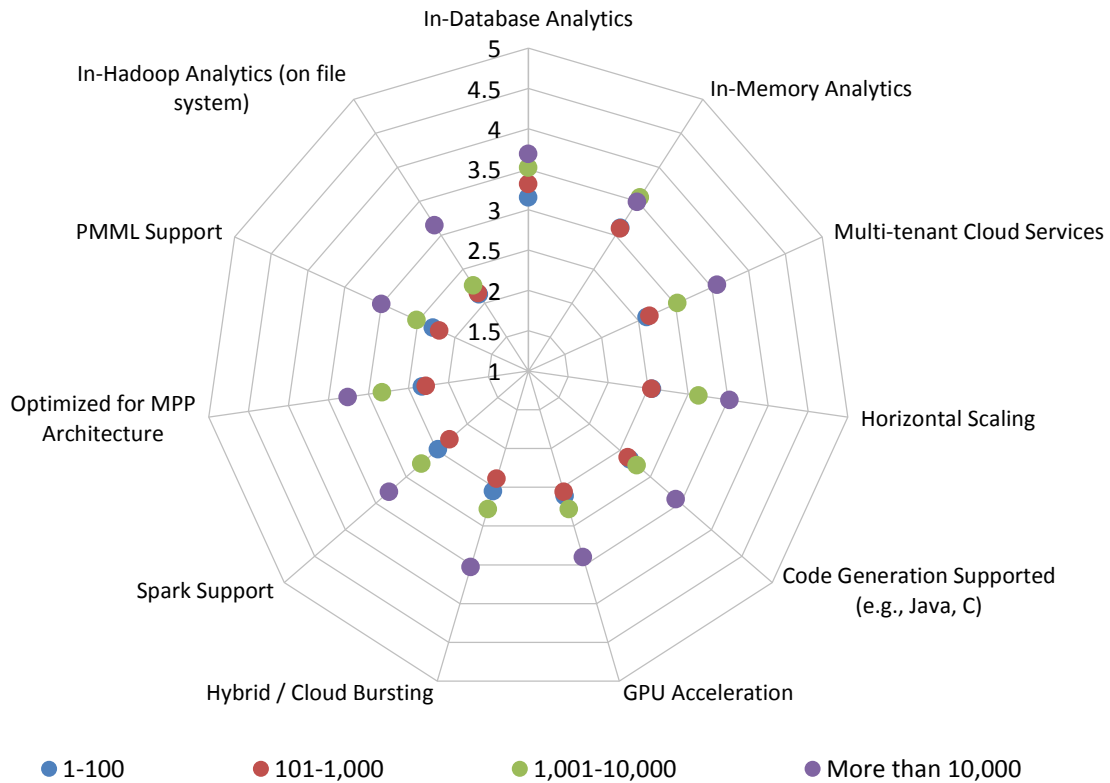


Figure 56 – Scalability of data science and machine learning by organization size

Neural Networks for AI, Data Science, and Machine Learning

We asked organizations to gauge their interest in six types or aspects of neural networks in the context of AI, data science, and machine learning (fig. 57). The top three picks in 2023 are *deep learning neural networks*, *artificial neural network*, and *recursive neural network*. Each of these three picks is seen as at least *important* to 38-45 percent of respondents. The remaining three choices, *long short-term memory*, *convolutional neural networks*, and *adversarial neural networks*, are at least *important* to 32-37 percent of respondents. Also worth noting, between 35-41 percent of respondents *don't know* the importance of any of the six neural network choices, though just 8-13 percent think any are *not important*. (Also see industry support, fig. 73)

Neural Networks for AI, Data Science, and Machine Learning

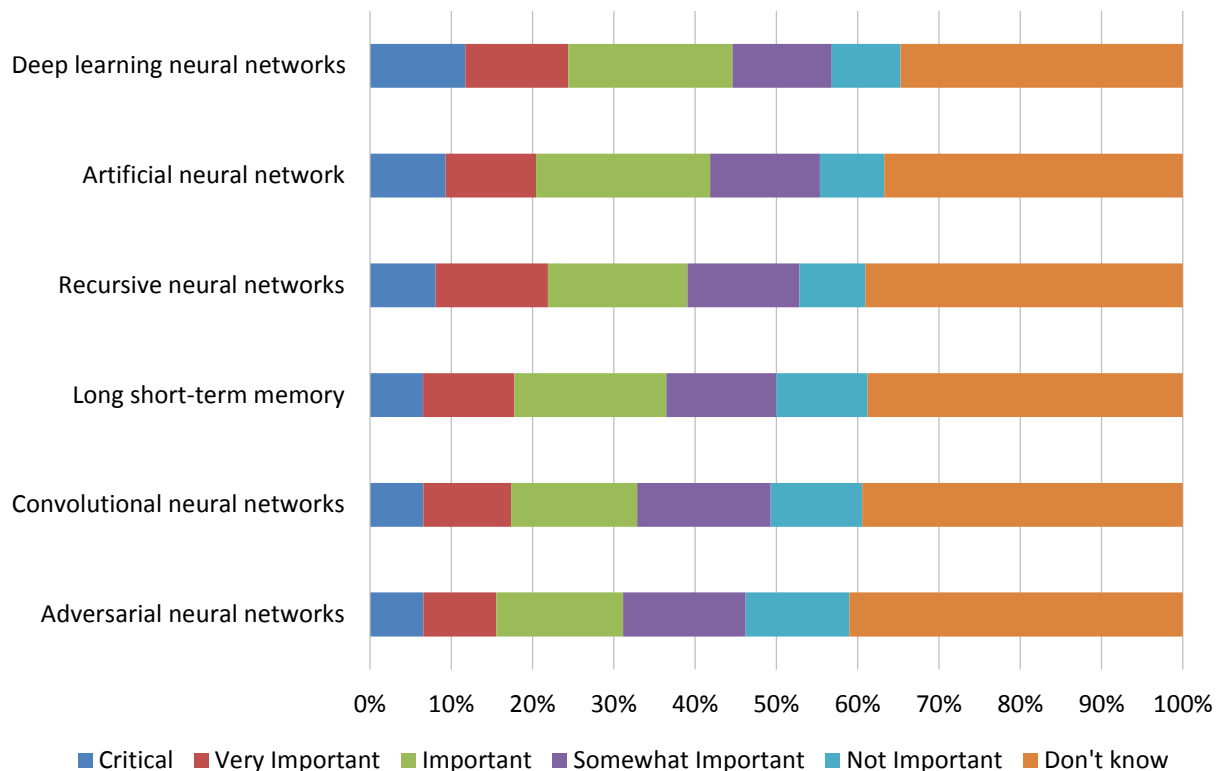


Figure 57 – Neural networks for AI, data science, and machine learning

2023 AI, Data Science, and Machine Learning Market Study

Neural Networks for AI, Data Science, and Machine Learning 2019-2023

Across the last five years of data, respondents most often report a constrained range of interest in the four or six neural networks that we polled in the context of AI, data science, and machine learning (fig. 58). We added two choices beginning in 2022: *adversarial neural networks* and *deep learning neural networks*. Most dramatically, the latter selection, *deep learning neural networks*, resonated immediately on arrival, perhaps driven by contemporary fixation on large language models and generative pre-trained transformer (GPT) rollouts. In 2023, *deep learning neural networks* is the top pick and the only choice considered greater than *important* to respondents. The former top choice, *artificial neural network*, remains at a level of *important*, as does *recursive neural network*. We expect that variations and standardization of nomenclature around neural networks will become more commonly understood in future time frames.

Neural Networks for AI, Data Science, and Machine Learning 2019-2023

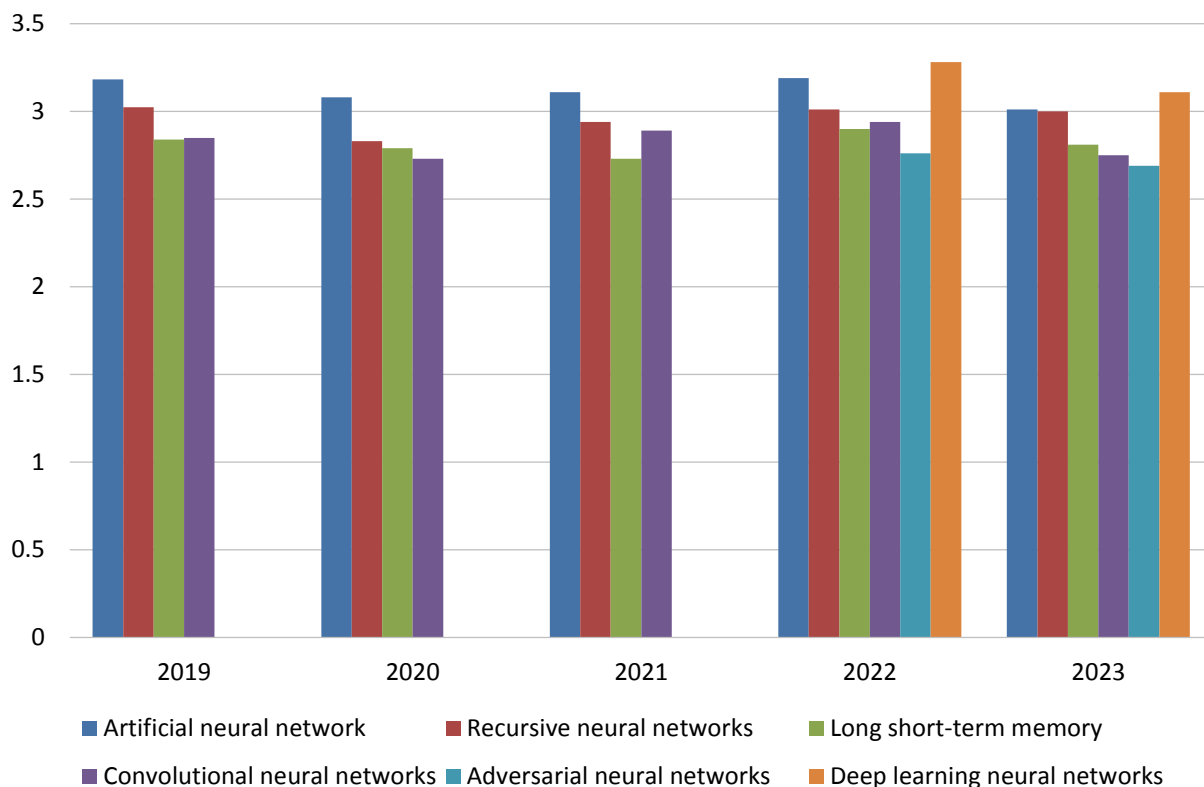


Figure 58 – Neural networks for AI, data science, and machine learning 2019-2023

2023 AI, Data Science, and Machine Learning Market Study

Neural Networks for AI, Data Science, and Machine Learning by Industry

Attitudes toward types of neural networks in the context of AI, data science, and machine learning vary by industry, with 2023 interest most often led by respondents in *healthcare* and *education* (fig. 59). This year, for example, respondents in *education* (who might represent actual use or academic research), lead or share the greatest interest in *artificial neural networks*, *deep learning neural networks*, *long short-term memory*, and *recursive neural networks*. *Healthcare* respondents show high interest in all network types and lead or share the greatest interest in *adversarial neural networks*, *deep learning neural networks*, *long short-term memory*, and *recursive neural networks*. In contrast, *retail and wholesale* and *manufacturing* respondents exhibit the lowest importance scores for neural network types. Closer to average scores are among respondents in *financial services*, *business services*, *technology*, and *consumer services*.

Neural Networks for AI, Data Science, and Machine Learning by Industry

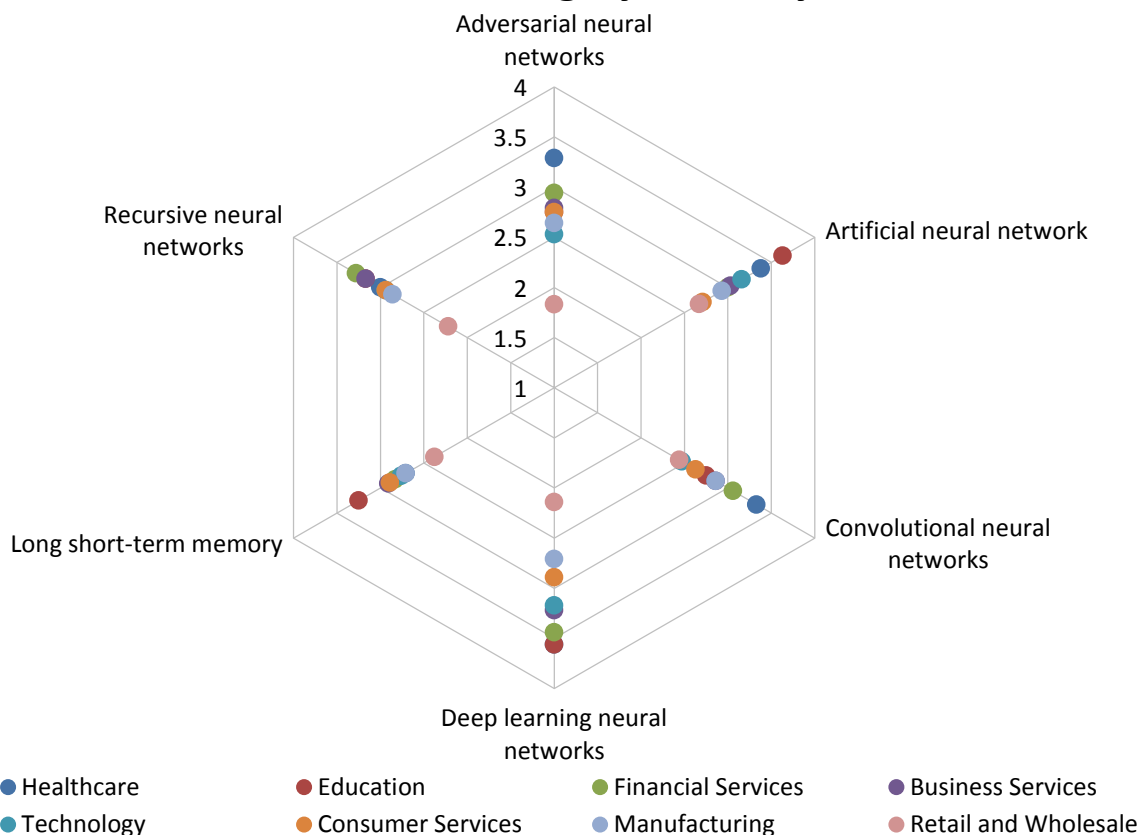


Figure 59 – Neural networks for AI, data science, and machine learning by industry

Generative AI

Generative AI uses machine-learning algorithms (e.g., neural networks) to create large language models (LLM), enabling the generation of new and original data, images, text, or programming code that best approximates to the training data used. The most prominent example of generative AI today is ChatGPT. Although ChatGPT is available as a stand-alone offering, numerous enterprise software vendors recently released or soon will provide ChatGPT extensions and plug-ins for their enterprise applications—including many data and analytics products.

Twenty-nine percent of organizations say they use generative AI today, mostly in experimental, non-production rollouts (fig. 60). A majority of organizations—64 percent—directly or indirectly deferred dealing with generative AI. Only 6 percent of this majority plan to use generative AI but do not expect to do so for more than a year. The other 58 percent of organizations report no plans or don't know if plans exist for using generative AI.

Generative AI Adoption Plans

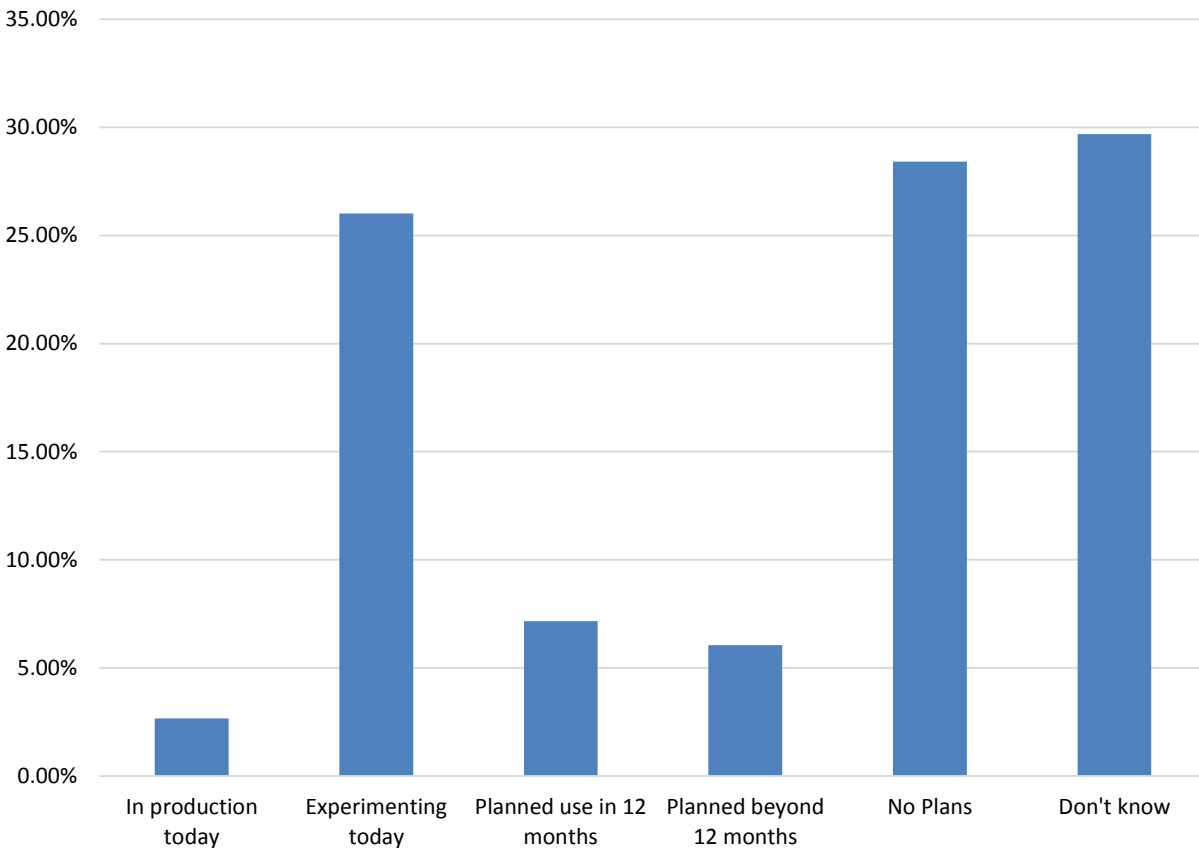


Figure 60 – Generative AI adoption plans

2023 AI, Data Science, and Machine Learning Market Study

Generative AI by Geography

Adoption plans for generative AI do not vary dramatically by geography in 2023 (fig. 61). This year, weighted-mean sentiment is narrowly higher in Asia Pacific (2.7), versus EMEA (2.5) and North America (2.5). Asia Pacific respondents have the largest percentage of experimental users (35 percent) but report no production use, which is present but admittedly minimal (4 percent or less) in EMEA and North America. Asia Pacific respondents are less likely to report *don't know* or *no plans* (50 percent), compared to EMEA (57 percent) and North America (60 percent).

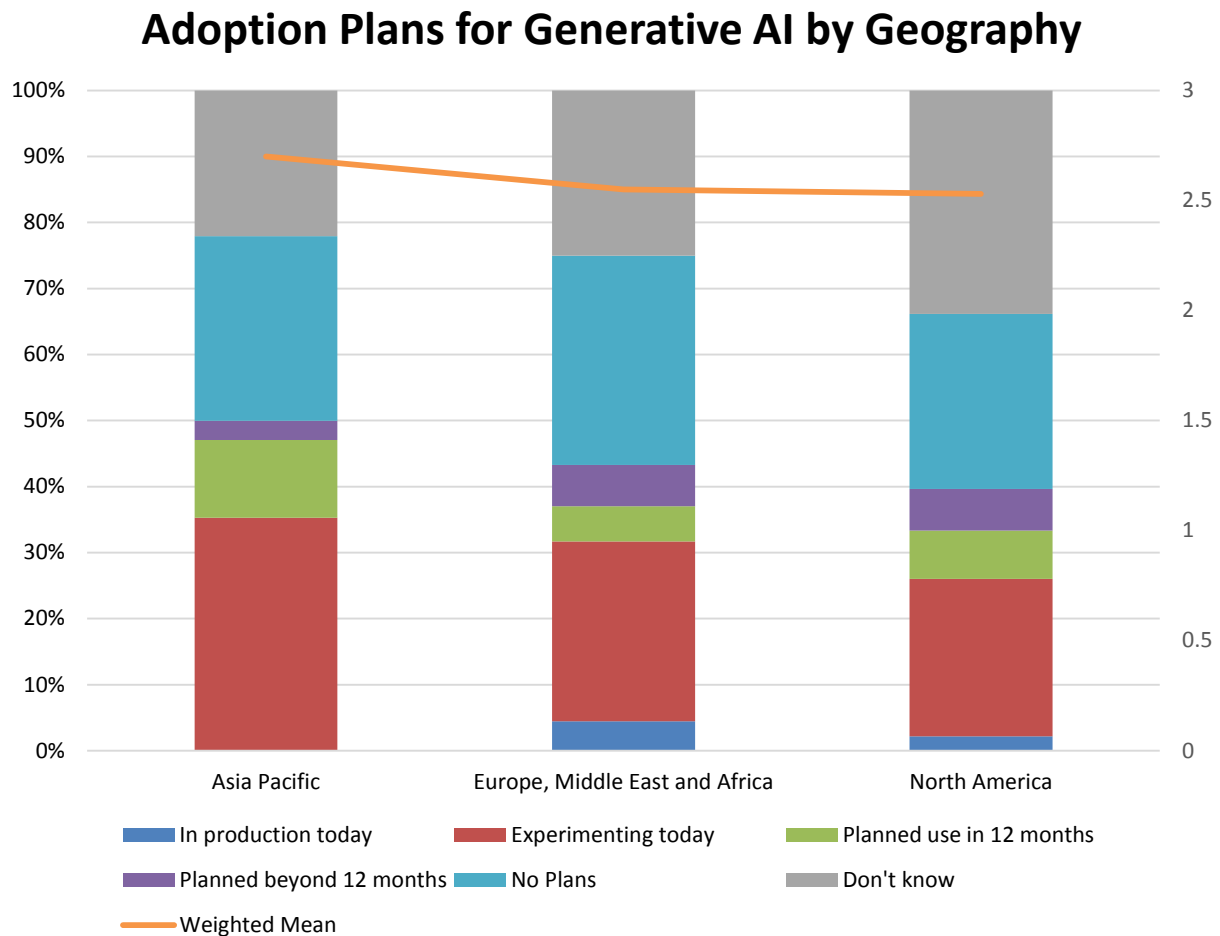


Figure 61 – Adoption plans for generative AI by geography

Generative AI by Function

A view of adoption plans by functions reveals interest that is highest in *R&D* and, interestingly, *executive management* (fig. 62). Somewhat surprisingly, executive management indicates one of the highest levels of experimentation with generative AI (also tied with marketing, which, as a content-centric function, is more expected). At the other extreme, *sales* and *finance* report the lowest levels of experimentation. This year, only *marketing* and *sales* report no *production* use of generative AI in 1Q23 (although the percentage of production use across other functions is admittedly very low at 5 percent or less). The notable experimental use reported by respondents in multiple front- and back-office functions indicates a likely need for additional research and data refinement.

Adoption Plans for Generative AI by Function

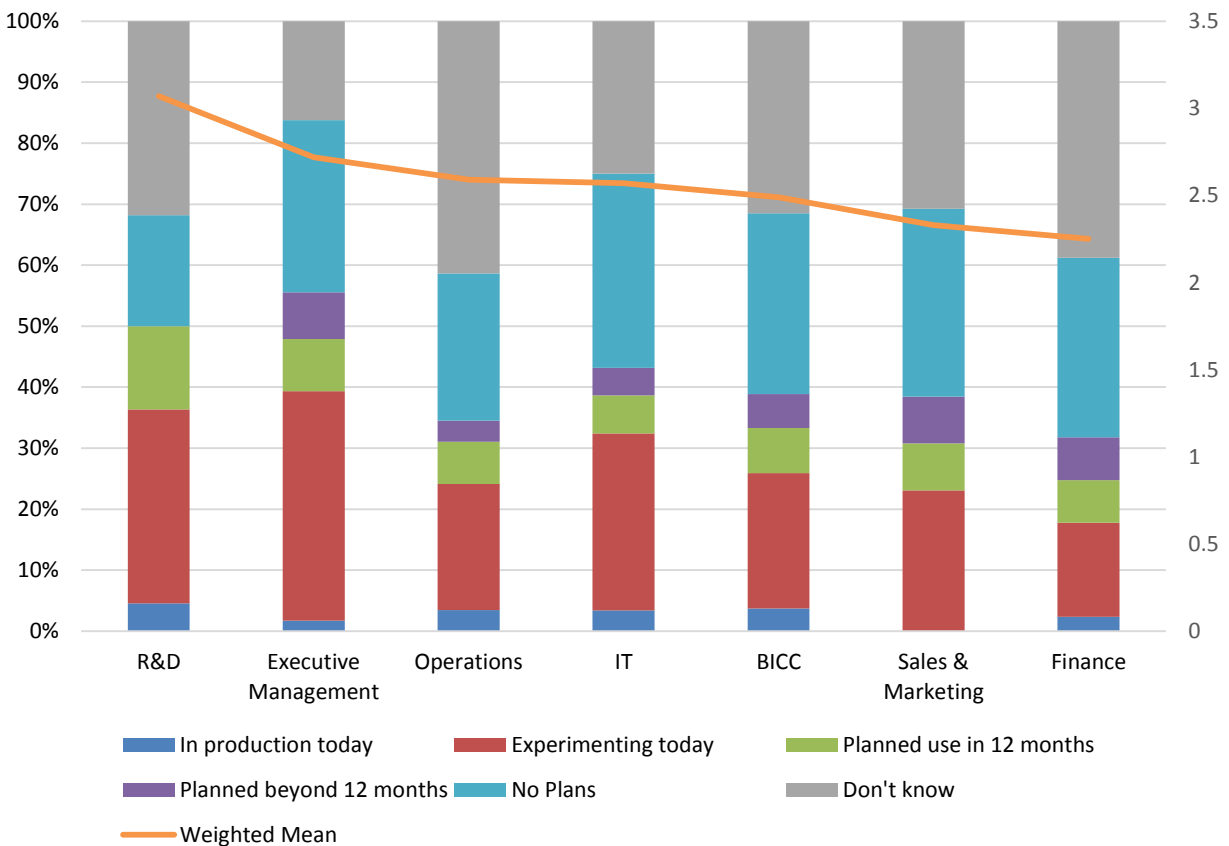


Figure 62 – Adoption plans for generative AI by function

2023 AI, Data Science, and Machine Learning Market Study

Generative AI by Industry

2023 plans by industry show some first-mover leadership in *technology* and *business services*, which, unlike all other industries, assign greater than *important* interest in adopting generative AI (fig. 62). These two industries also report the highest *production* and *experimental* use, and quite distinctly the greatest *planned* use in 12 and 24-month time frames (greater than a total 50 percent, compared to 40 percent or far less in all other industries). To a lesser extent, respondents in *education*, *consumer services*, and *financial services* represent a second tier of interest. *Healthcare* (which contrarily reports a uniquely high interest in neural networks for AI, data science, and machine learning, fig. 59), reports the lowest combined *experimental* and *planned* future use of generative AI this year (22 percent).

Adoption Plans for Generative AI by Industry

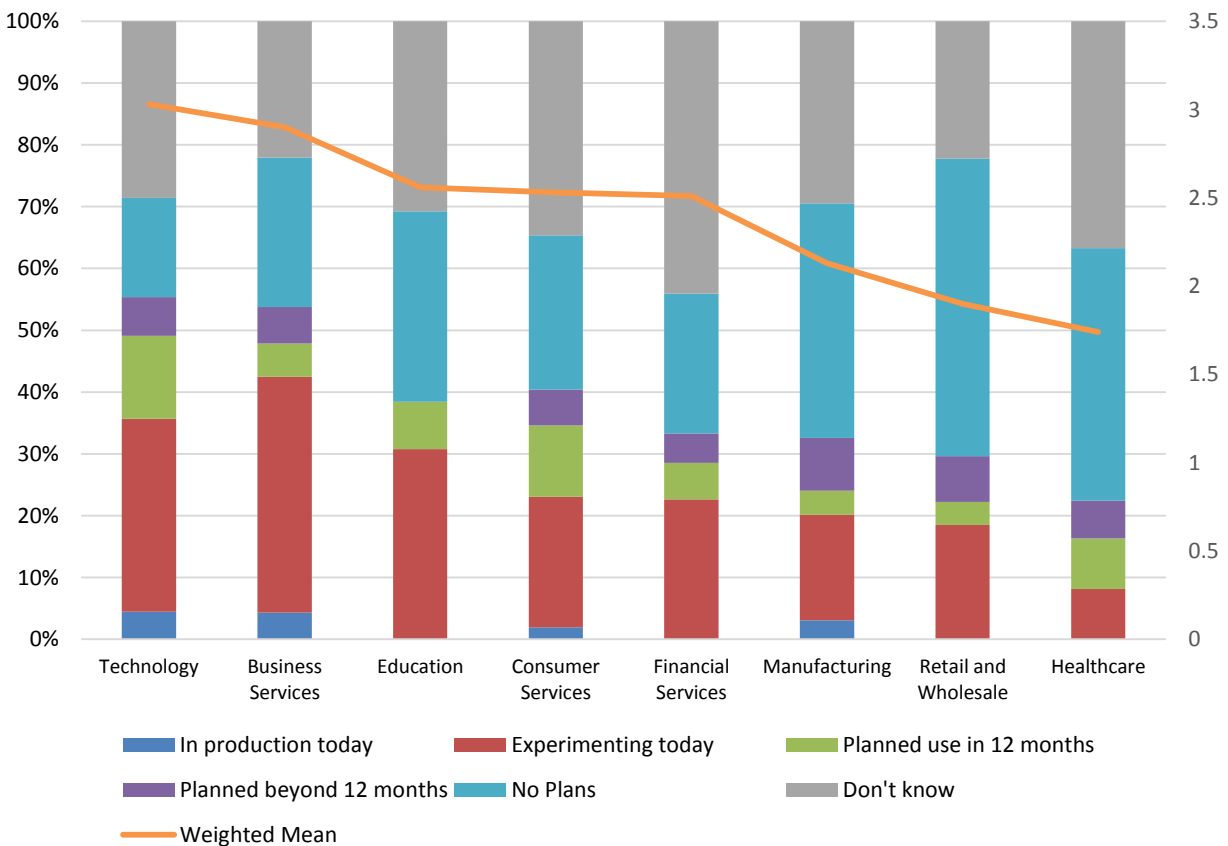


Figure 63 – Adoption plans for generative AI by industry

Generative AI by Organization Size

Viewed by organization size, adoption plans for generative AI show a significant bifurcation in current and planned adoption (fig. 64). The smallest and largest organizations both most frequently report production use of and experimentation with generative AI. These data suggest these sizes of organizations already see potential value from using generative AI. Many of the smallest organizations might also perceive generative AI as a tool to create sources of competitive differentiation in early stages of AI adoption. Many of the largest organizations might perceive the value of generative AI arising from both enabling competitive differentiation and potentially reducing costs significantly due to these organizations' size and scale.

Adoption Plans for Generative AI by Organization Size

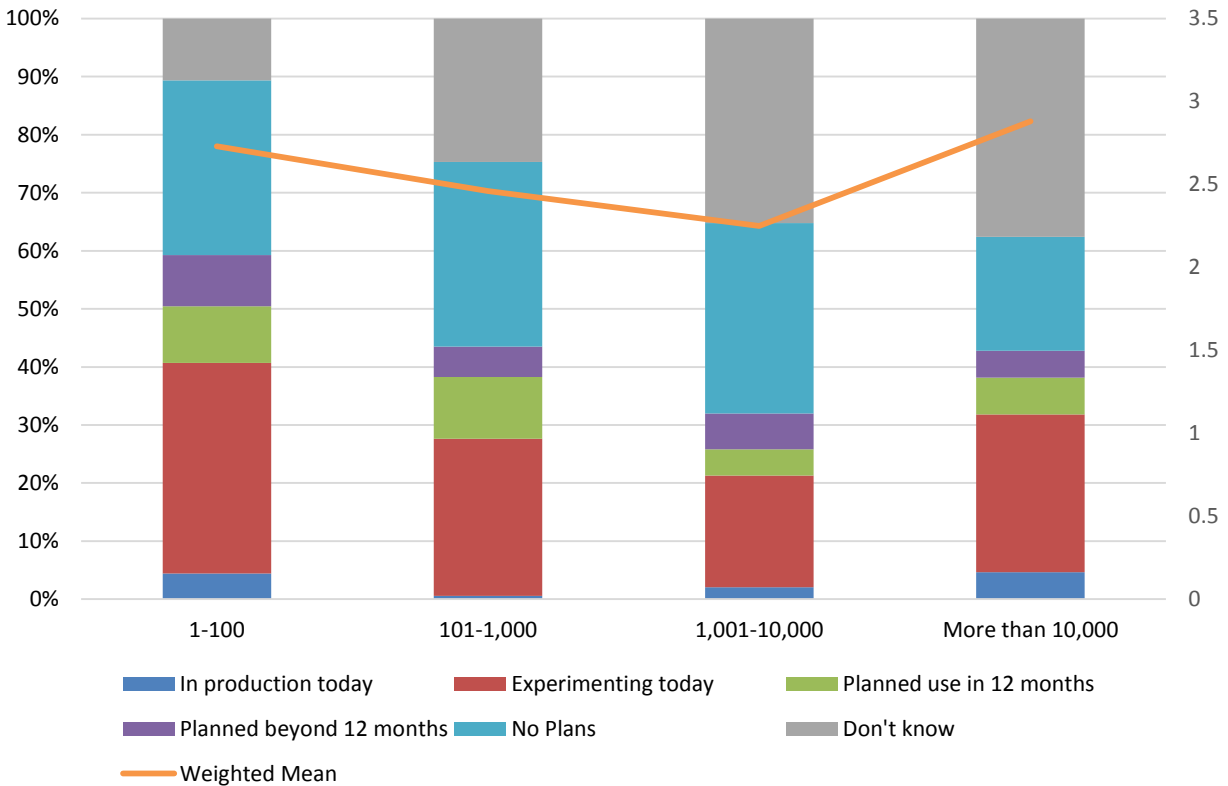


Figure 64 – Adoption plans for generative AI by organization size

Generative AI by Data Literacy

Organizations that perceive higher accomplishment in the pursuit of data literacy are more likely to be adopters and future users of generative AI (fig. 65). At the extremes, organizations with *extremely high* data literacy are more than twice as likely (52 percent) to be production or experimenting users of generative AI, compared to 25 percent at organizations with *very low* data literacy. The implications of this finding are intuitive: those that are able to explore, understand, and communicate with data in a meaningful way are likely most able to adopt, learn, and advance the use of generative AI.

Adoption Plans for Generative AI by Data Literacy

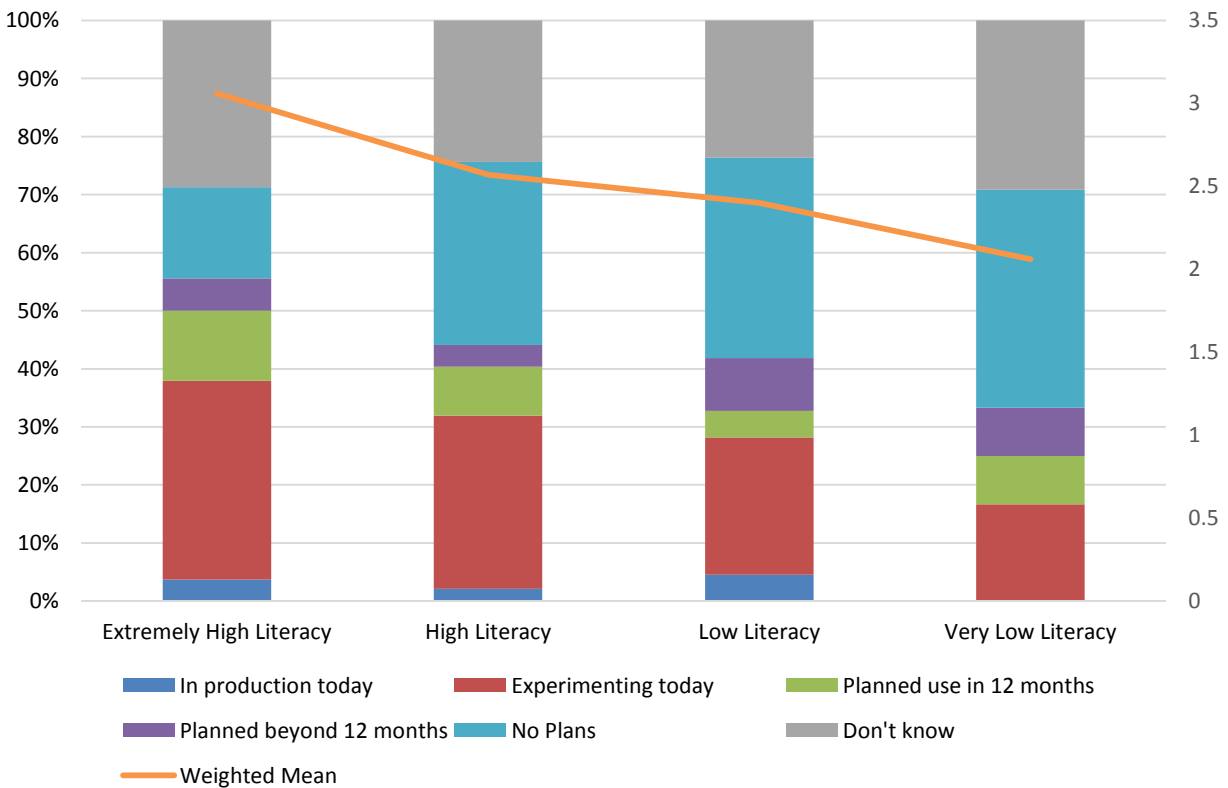


Figure 65 – Adoption plans for generative AI by data literacy

Open Source and AI, Data Science, and Machine Learning

Our last three annual studies of open source, AI, data science, and machine learning track a level of interest that is consistently high but not advancing rapidly (fig. 66). Between 2021 and 2023, 60-70 percent reported the topics to be, at minimum, *important*, though this summary finding (along with standalone scores of *critical* importance), declined somewhat between 2022 and 2023. There are multiple ways to interpret this finding. First, as a relatively new set of mainstream topics, sentiment is very favorable, if perhaps not conclusive, toward the future impact of these technologies. Also, the hype and excitement surrounding AI settled somewhat as immediate implications and use cases are still being digested. While some definitions in this category (open source, data science, machine learning) are well understood and defined, the gap between conception and execution of artificial intelligence remains an unexhausted and incomplete discipline that is unlikely to recede in importance. (Also see industry support, fig. 79).

Importance of Open Source AI, Data Science, and ML Technologies 2021-2023

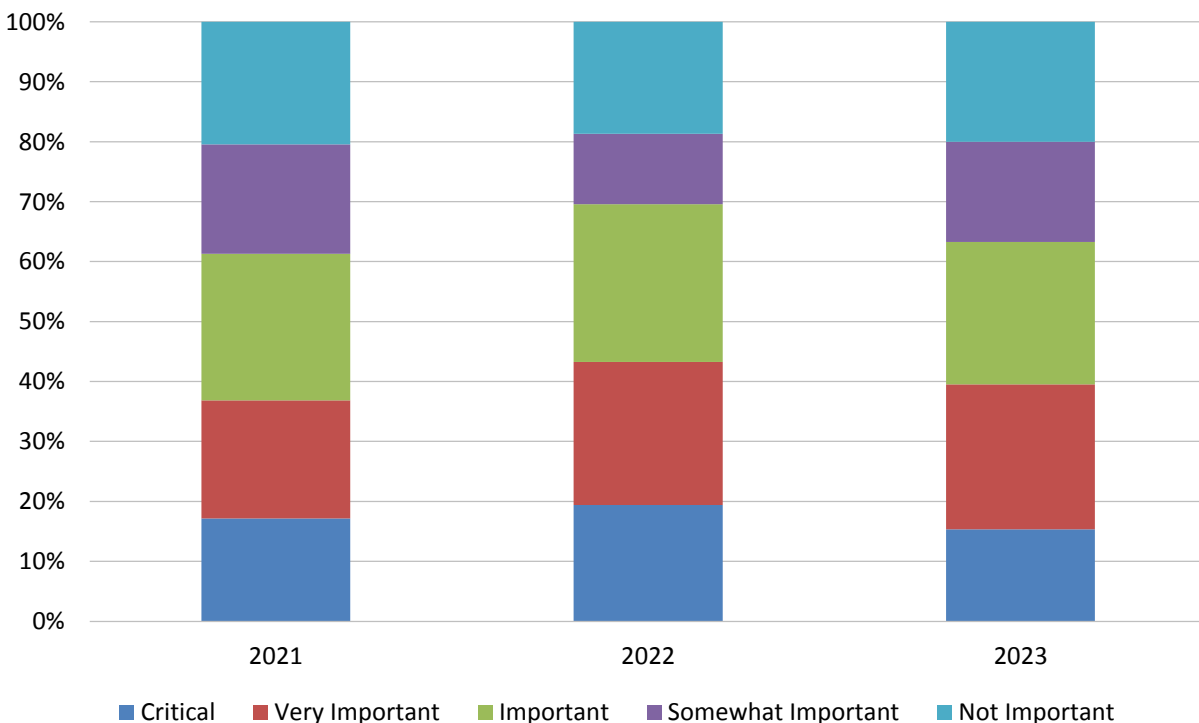


Figure 66 – Importance of open source AI, data science, and ML technologies 2021-2023

2023 AI, Data Science, and Machine Learning Market Study

Open-Source Features for AI, Data Science, and Machine Learning

We asked organizations to gauge their interest in 15 (four new added in 2022) open-source features for AI, data science, and machine learning (fig. 67). The top four features (*Azure data factory*, *support for Apache big data services*, *Databricks*, and *Kafka*) stand alone as those that are at most *important* to majorities (50-67 percent) of respondents. A second tier consisting of *Google Dataflow*, *Elasticsearch*, and *Amazon Kinesis* follows in importance. (We note that former category leader *Spark* slipped to midlevel but still greater than 40 percent *important* relevance.) All but two of 15 services are, at minimum, *somewhat important* to more than half of all respondents.

Open Source Features for AI, Data Science, and Machine Learning

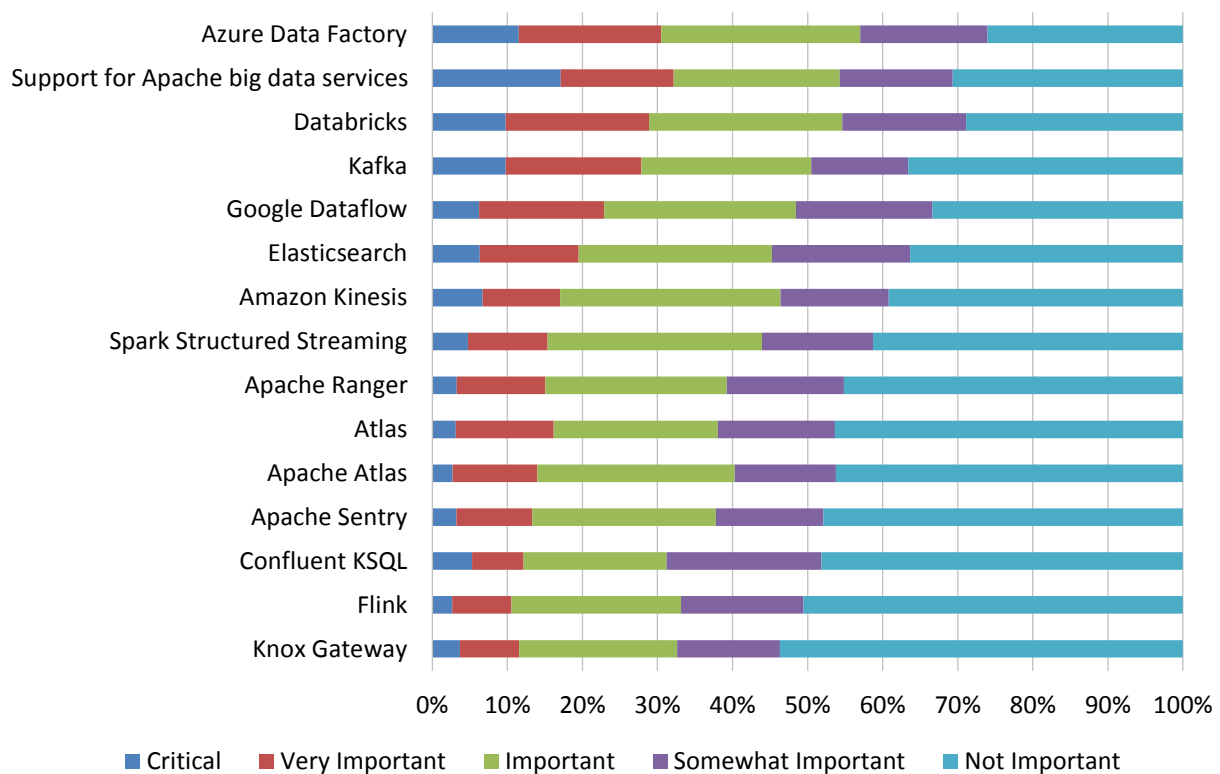


Figure 67 – Open source features for AI, data science, and machine learning

2023 AI, Data Science, and Machine Learning Market Study

Open-Source AI, Statistical, and Machine Learning Technologies

We asked organizations to gauge their interest in 17 (six new added since 2022) AI, statistical, and machine learning technologies (fig. 68). Within this category, all technologies have relevant importance, led by *Pandas*, *R language*, *Tensorflow*, and *Pytorch*, all of which are, at minimum, important to more than 59-64 percent of respondents. A second tier consisting of *Anaconda*, *scikit-learn*, *MLflow*, *Spark Mlib*, and *Kubeflow*, are at least *important* to 43-52 percent. All but one technology is at least *somewhat important* to more or far more than half of respondents. (Also see industry importance, fig. 80.)

Open Source AI, Statistical, and Machine Learning Technologies

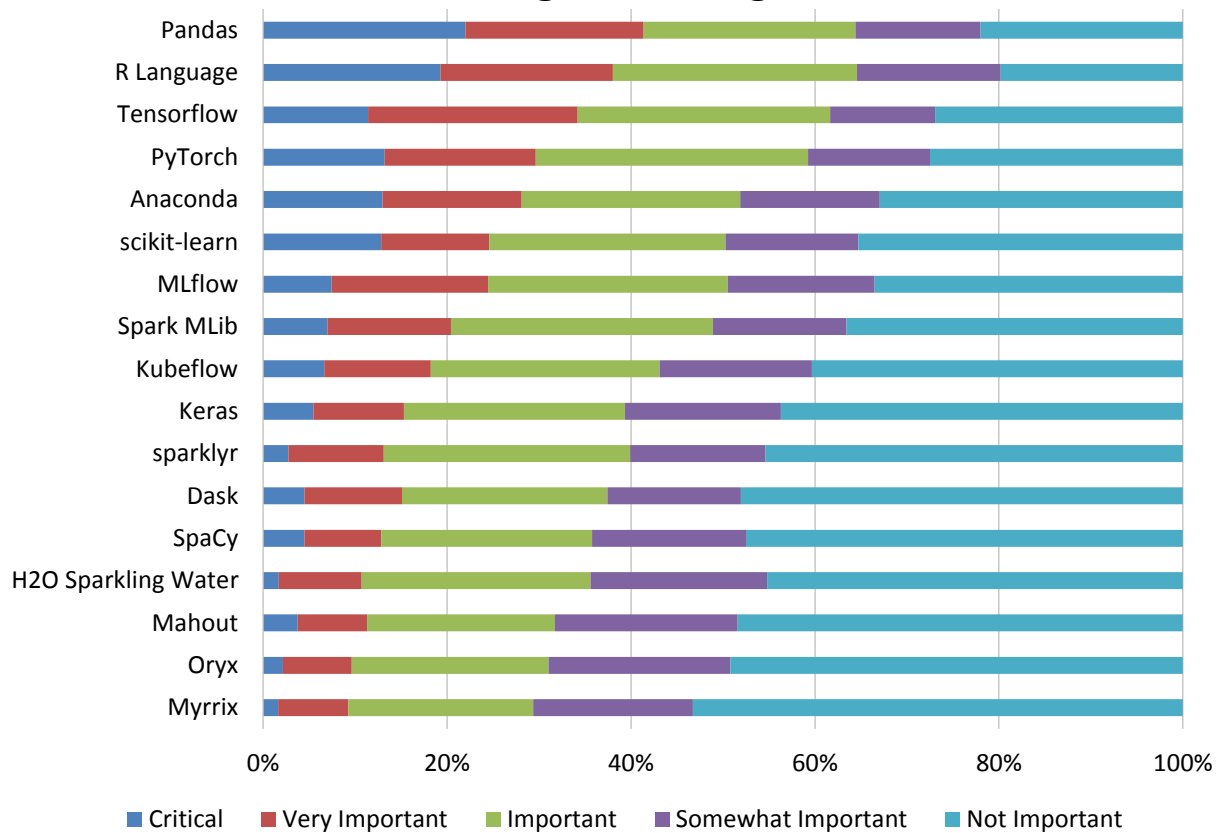


Figure 68 – Open source AI, statistical, and machine learning technologies

2023 AI, Data Science, and Machine Learning Market Study

Data Sources for AI, Data Science, and Machine Learning

We asked organizations to gauge their interest in 32 (five new added since 2022) data sources for AI, data science, and machine learning (fig. 69). Within this category, nearly all choices have relevance to respondents. Three of these (*Snowflake*, *Amazon S3*, and *Amazon Redshift*) are, at minimum, *important* to nearly 60 percent or more respondents in 2023. At least 19 sources are at least *important* to 40 percent or more respondents. All but seven of 32 sources are, at minimum, *somewhat important* to about half or more respondents. (Also see industry importance, fig. 81.)

Data Sources for AI, Data Science, and Machine Learning

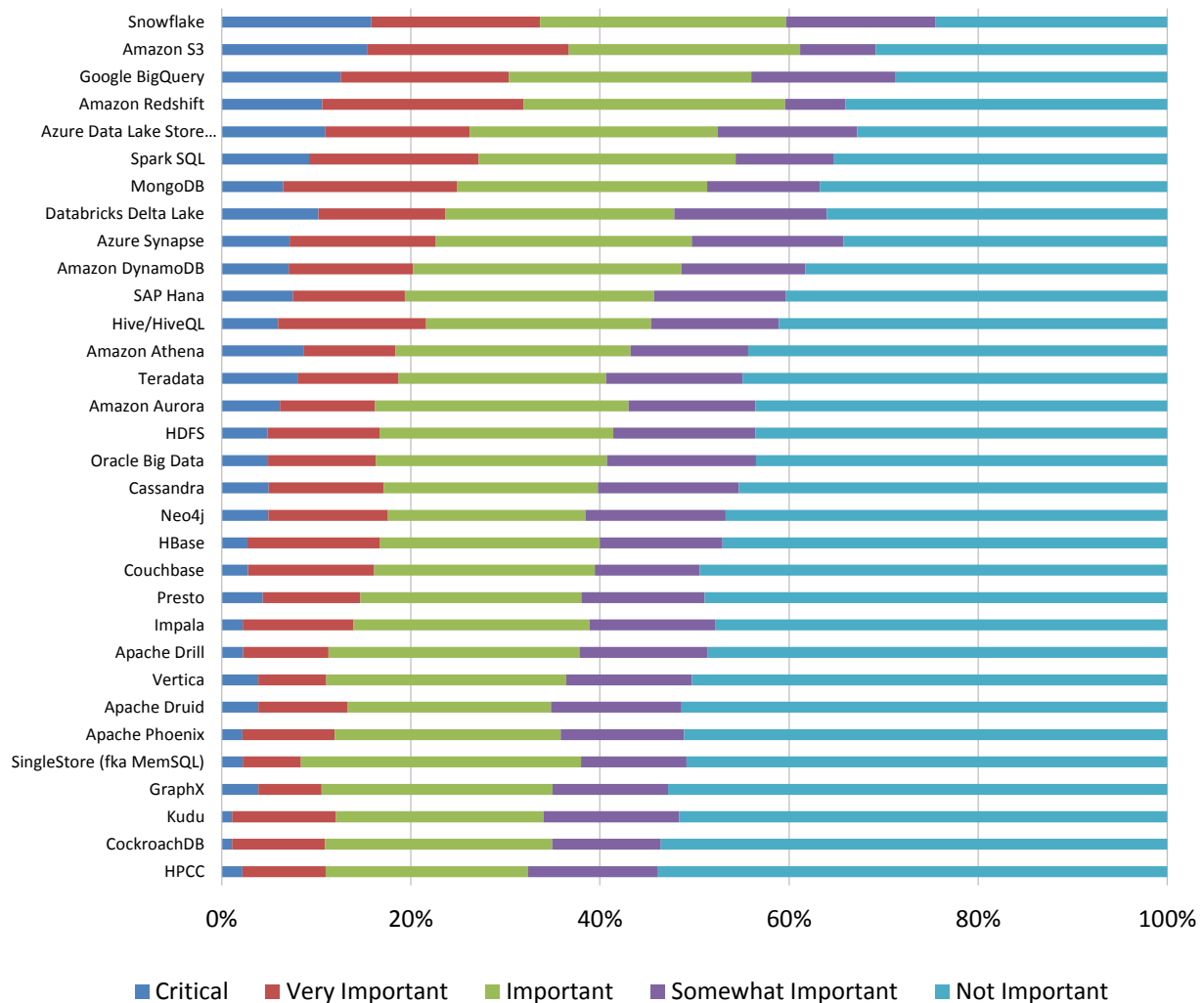



Figure 69 – Data sources for AI, data science, and machine learning



Industry and
Vendor
Analysis

Industry and Vendor Analysis

Industry Importance of AI, Data Science and Machine Learning

One telling view of the sustained prospects and enthusiasm for AI, data science, and machine learning is industry sentiment over time, as shown in figure 70. From a steady and impressive rise during 2015-2021, we see some leveling of enthusiasm during 2022 and 2023, when industry importance appeared to flatten at a weighted-mean level of 4.5. We might describe the current term as “peak” AI, data science, and machine learning, in part because of the rarity of sustained topical importance midway between *very important* and *critical* on our scoring scale. Even so, while weighted-mean scores are unchanged year over year, we observe a decline in *critical* scores compensated by higher *very important* scores. Not unusually, industry excitement is still ahead of user sentiment (fig. 13). As we observed in earlier studies, investments toward mainstreaming data science and machine learning should pave a path awaiting widely applicable solutions, support from services and cloud architectures, and user uptake.

Industry Importance of AI, Data Science, and Machine Learning 2014-2023

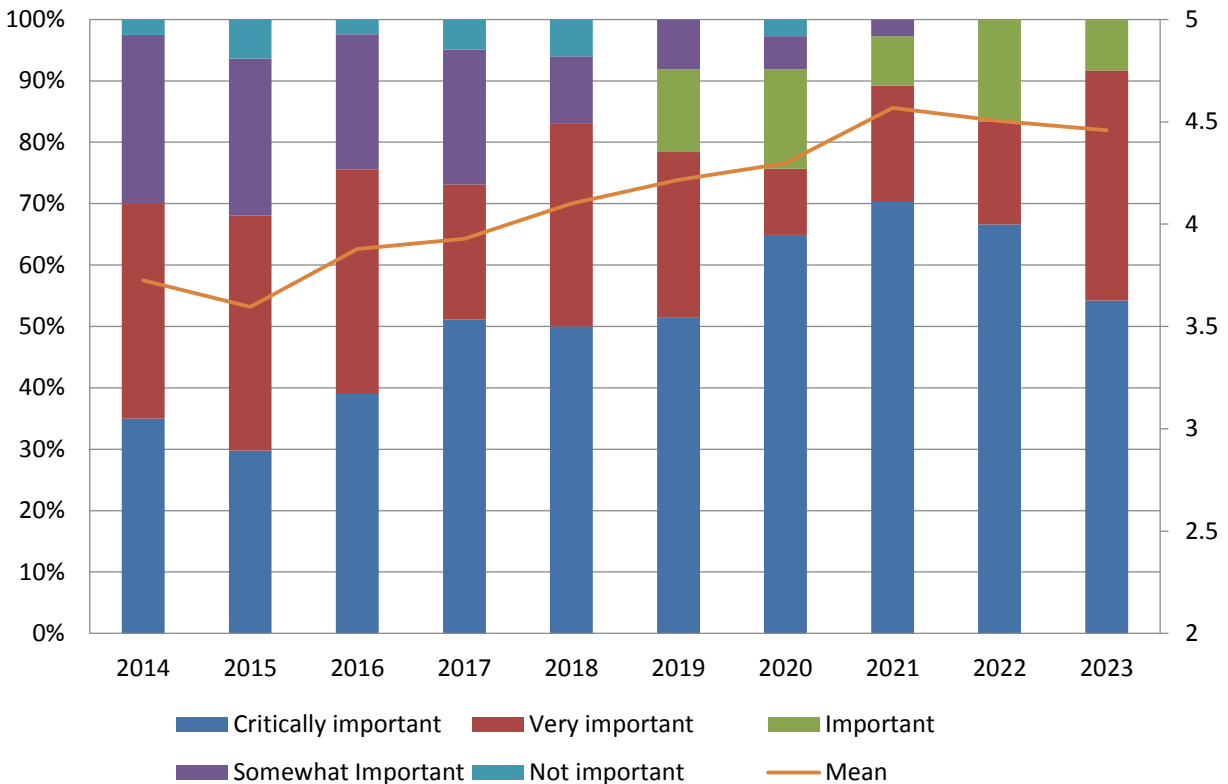


Figure 70 – Industry importance of AI, data science, and machine learning 2014-2023

Industry Support for Analytical Features and Functions

Industry respondents strongly support multiple analytical features and functions in 2023, led by core *outlier detection*, *range of regression models*, and *textbook statistical functions* (fig. 71). All three features are at 85-95 percent currently supported and nearing full maturity. Support tapers only somewhat for *various approaches to CART*, *hierarchical clustering*, and *optimization*, though these, along with *Bayesian methods*, are expected to be 100 percent supported in future time frames. Somewhat remarkably, all 20 analytical features sampled in 2023 are at least 50 percent currently supported, and all are expected to be at least 80 percent supported in future time frames. Vendor priorities toward features mostly align well with, and are mostly far ahead of, user feature requirements this year (fig. 39).

Support for Analytical Features and Functions

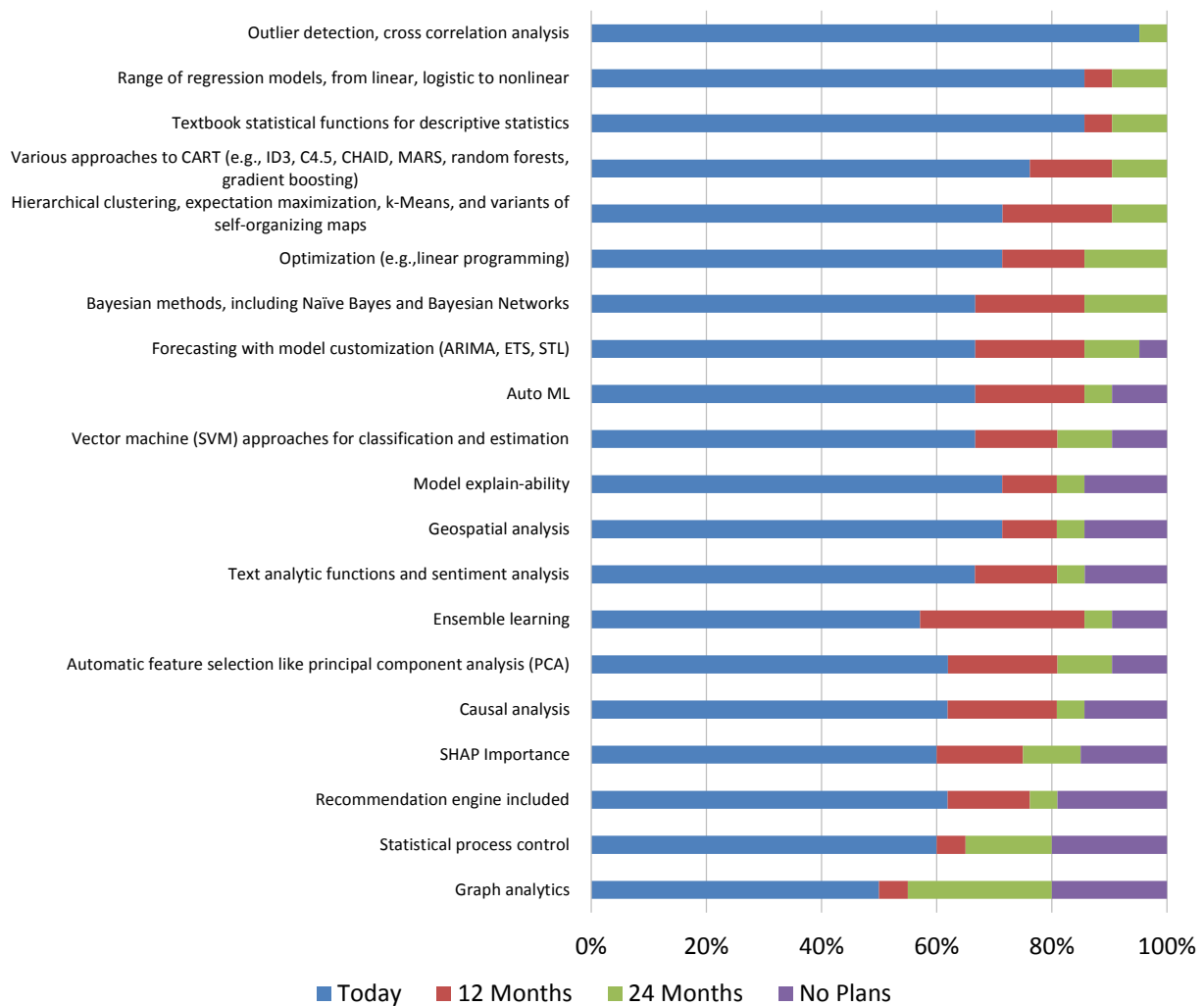


Figure 71 – Industry support for analytical features and functions

2023 AI, Data Science, and Machine Learning Market Study

Viewed across nine years of data gathering, analytical feature and function support visibly jumped sharply in 2022 and sustains existing and new momentum into 2023 (fig. 72). Prior to this reversal, between 2015 and 2020, the industry reported an uncertain pattern of increases and decreases in investment support for analytical features and functions. This year, some feature support falls below peak levels observed in 2022; but we also observe new high or sustained levels in areas including *outlier detection*, *optimization*, *auto ML*, *vector machine approaches*, *automatic features for selection*, *SHAP importance*, and *statistical process control*.

Support for Analytical Features and Functions 2015-2023

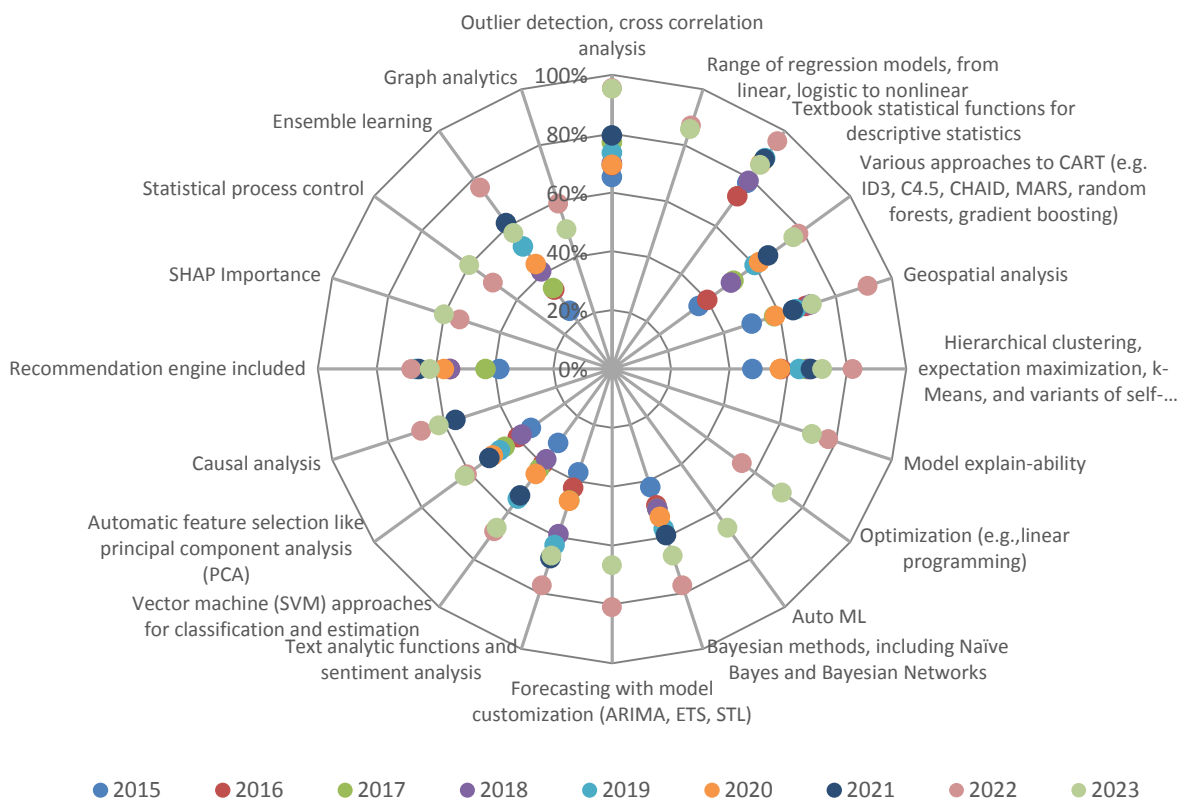


Figure 72 – Support for analytical features and functions 2015-2023

Industry Support for Neural Networks

We asked the vendor community to describe their support for seven (two added in 2022) types of neural networks and find current levels still limited, growing, and broadly similar (fig. 73). This year, current support is highest for *long short-term memory* and *artificial neural networks* (>40 percent). Current support then declines to slightly more than 30 percent for feed-forward deep learning, recursive neural networks, deep belief networks, and convolutional neural networks. Significant investment is expected in 12 and 24-month time frames to 58-74 percent for all seven neural network models. (Also see user importance, fig. 57.)

Industry Support for Neural Networks

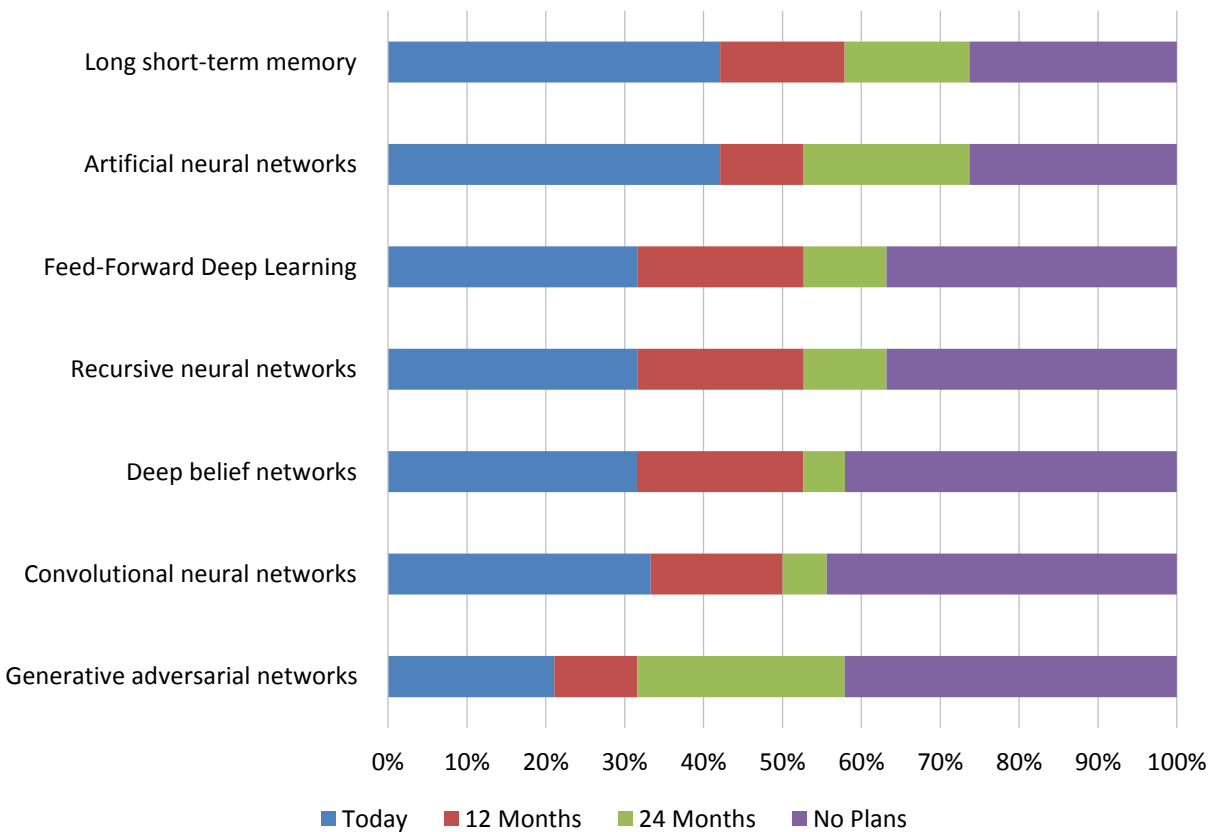


Figure 73 – Industry support for neural networks

Industry Support for Data Preparation

Data preparation, a core step in the data science and machine learning feature generation process, has very strong support today among software vendors in our 2023 industry survey (fig. 74). Current support for the top seven features (*data flows for multi-step transformations, cleansing and enrichment, complex filtering, support for cutting, merging, support for data type conversions, detection of duplicates, and set operations*) is at 90 percent or higher. The top 10 features all have at least 80 percent current support, and all but one 50 percent or far greater support today. Industry support at current levels is ahead of user feature requirements (fig. 45).

Industry Support for Data Preparation

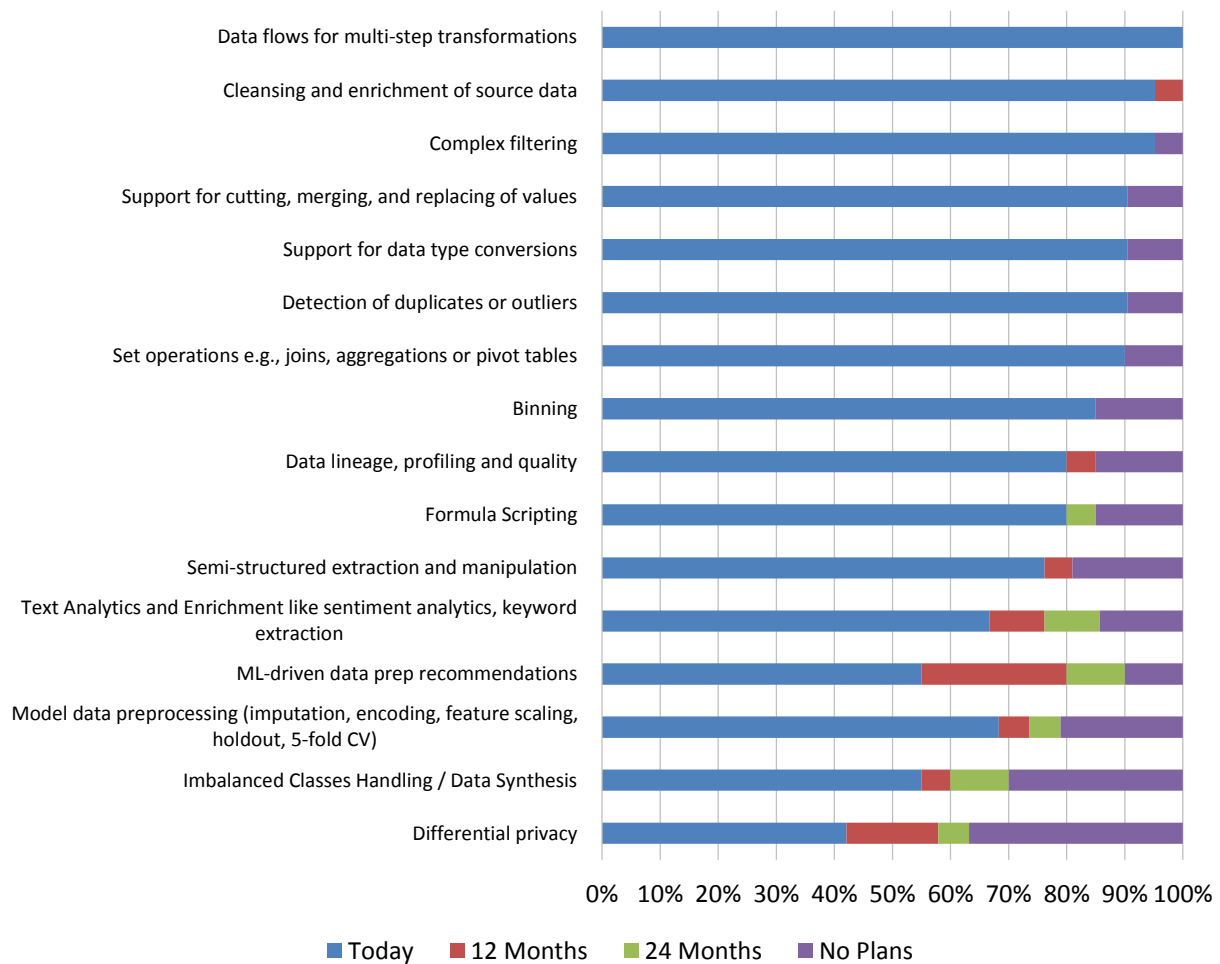


Figure 74 – Industry support for data preparation

Industry Support for Tool Usability

AI, data science, and machine learning tool usability features have very strong and broad industry support in 2023 (fig. 75). Ten of 16 sampled features, led by *fast cycle times for analysis* and *support for easy iteration*, are currently supported by 80 percent or far more of our industry sample. All features are currently supported by at least 60 percent of our industry sample, and vendors further expect future investments to raise support above 90 percent for eight leading features. Again, industry support well exceeds user criticality scores for every usability feature (fig. 48).

Industry Support for Tool Usability Features

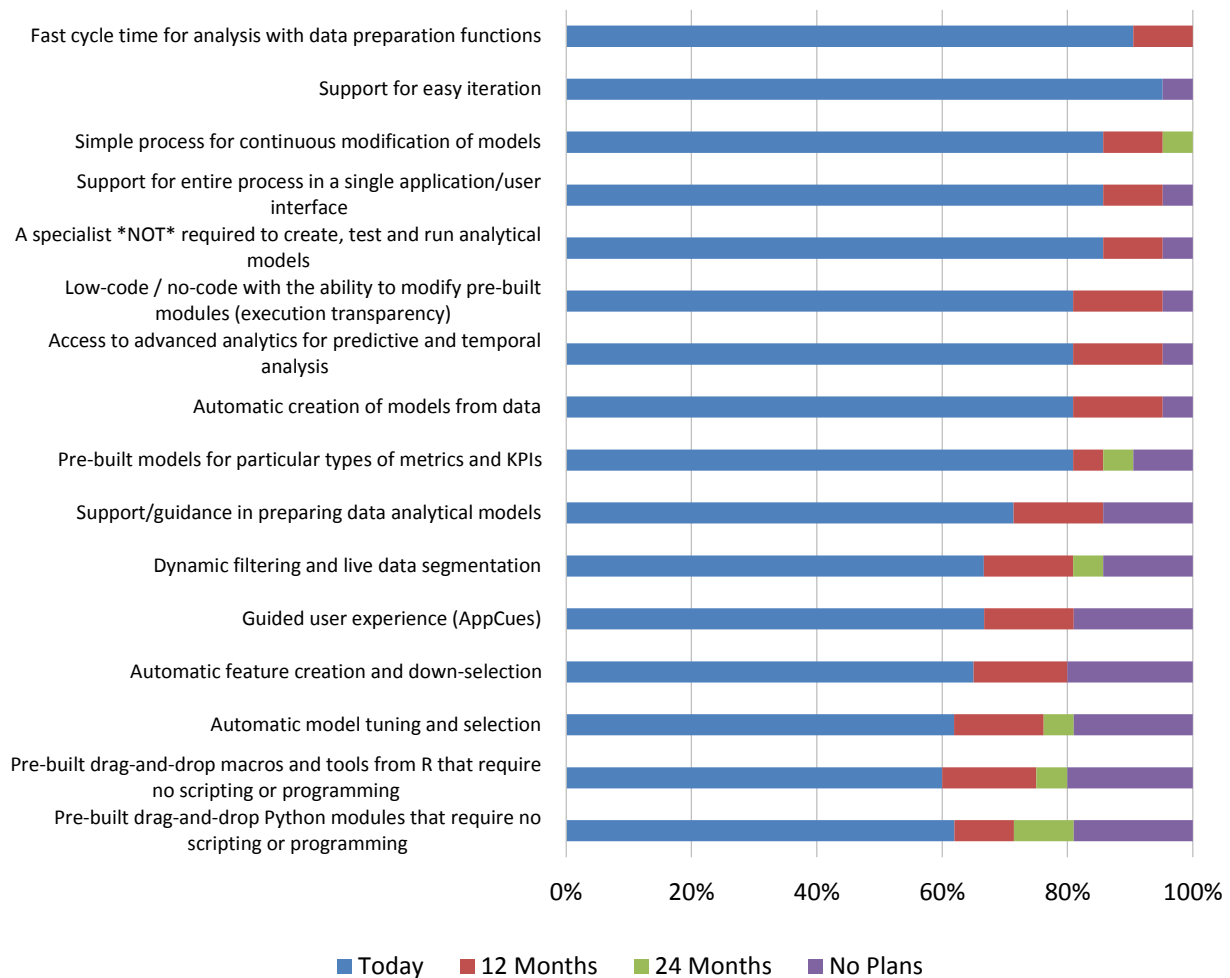


Figure 75 – Industry support for tool usability features

Industry Support for Scalability

Scalability of AI, data science, and machine learning can involve multiple different technologies and services to address high data volumes, large numbers of users, data variety, or analytic throughput. In our 2023 study, current industry support is 100 percent for *multi-tenant cloud services*, 95 percent for *in-memory analytics*, and 85 percent for *in-database analytics* (fig. 76). The latter two features are the most important scalability requirements for users (fig. 53). Other features supported by a majority of industry respondents include *horizontal scaling*, *optimized for MPP*, *Spark support*, *hybrid / cloud bursting*, and *in-Hadoop analytics*.

Industry Support for Scalability Features

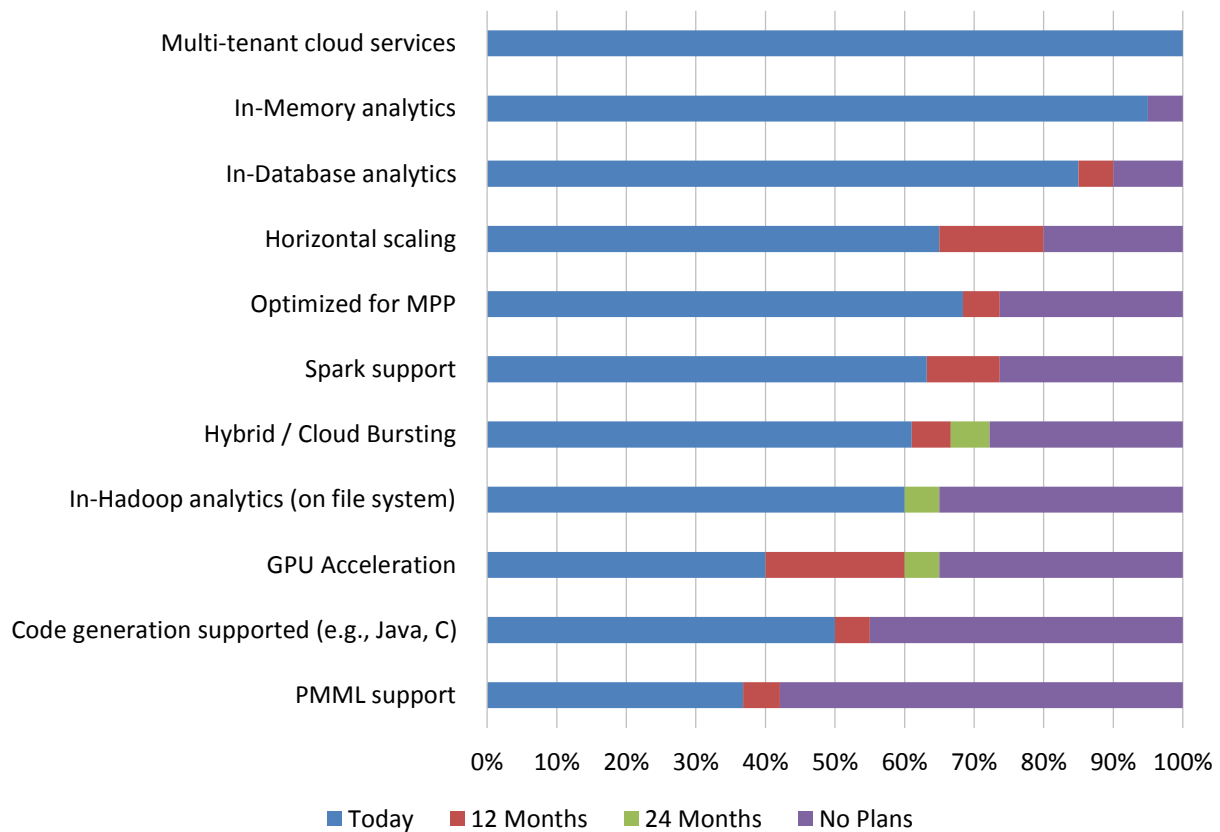


Figure 76 – Industry support for scalability features

Industry Sources of AI, Data Science, and Machine Learning Capabilities

In 2023, according to our criteria, the largest percentage of industry respondents (45 percent) best describe their analytical capabilities as *single product required, all features proprietary* (33 percent) or *single product required, or some features sourced from third party / open source* (33 percent) (fig. 77). The next most common finding is *multiple products required, some features sourced from third party / open source* (22 percent), and finally, *multiple products required, or all features proprietary* (11 percent). Thus, while more vendors provide the use of a single product or platform for all or most analytical capabilities, user scenarios vary widely according to use case or other circumstances.

Industry Source of Analytical Capabilities

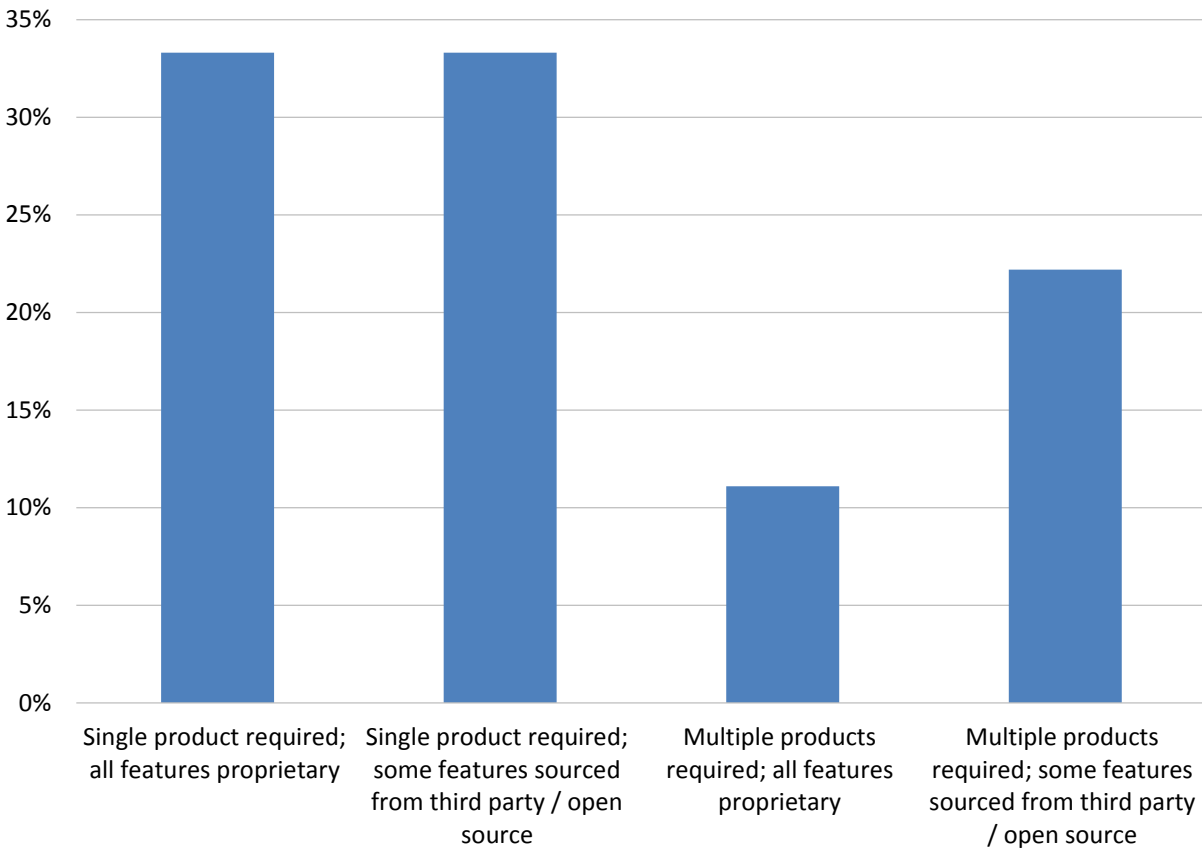


Figure 77 – Industry source of analytical capabilities

Open-Source Support

Industry respondents historically place a very high level of importance on open-source technology, a sentiment that carries strongly into 2023 (fig. 78). This finding, which relates to the broad developer community, can also be used to compare the industry importance of open source to user sentiment toward customizable versus pre-built features (fig. 67) for AI, data science, and machine learning technologies (fig. 68). In our current sentiment snapshot, we observe a year-over-year rebound in *critically important* industry sentiment (from 46 to 63 percent) and sustained *very important* sentiment. Thus, about 85 percent of industry respondents say that open-source technology is either *critical* or *very important*, and 95 percent say open source is at least *important*.

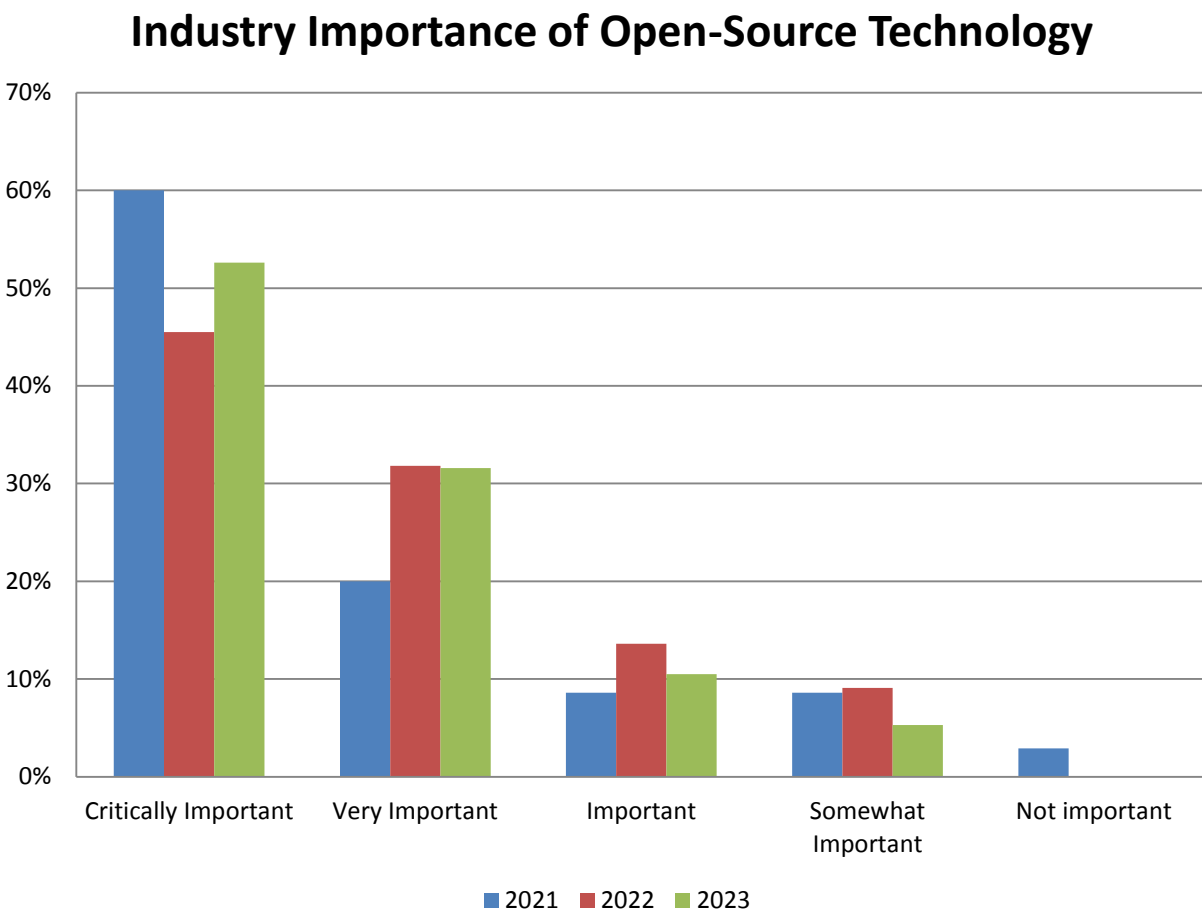


Figure 78 – Industry importance of open-source technology

Industry Support for Open-Source Infrastructure Technologies

Industry support for open-source infrastructure technologies in 2023 is broad and increasing year over year but is selective, still arguably immature, and in some cases limited (fig. 79). This year, we observe that *Spark* and *Databricks* are most supported today at 78 percent and 72 percent, respectively. The next most supported open-source infrastructure technologies are *Azure Data Factory* (63 percent), *Kafka* (59 percent), *Elasticsearch* (56 percent), and *Amazon Kinesis* (53 percent). No other technologies reach the level of 50 percent support in 2023, though vendors predict future investment will raise some of these numbers, particularly for *Apache Ranger*, *Apache Sentry*, and *Flink*. Half or more of our vendor community sample has *no plans* to address nine of the 16 infrastructure technologies we sampled. (Also see user importance, fig. 66.)

Industry Support for Open-Source Infrastructure Technologies

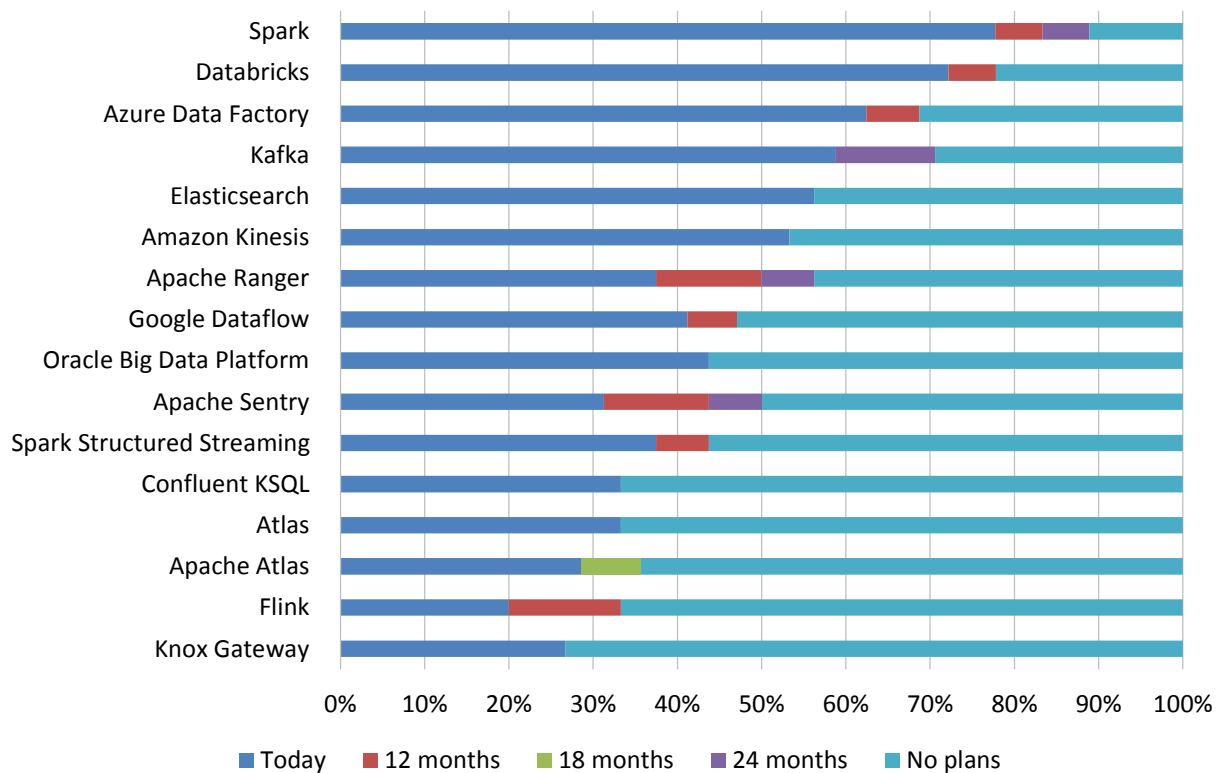


Figure 79 – Industry support for open-source infrastructure technologies

Industry Support for Open-Source Analytical and Machine Learning Technologies

The vendor/provider industry is selectively well invested in support for open-source analytical and machine learning technologies, with some plans for more future investment (fig. 80). Four technologies have 77-83 percent current industry support, led by *Pandas*, *R language*, *PyTorch*, and *scikit-learn*. A second tier consisting of *Tensorflow* (67 percent), *Anaconda* (65 percent), *Spark MLib* (56 percent), *MLflow* (53 percent), and *Keras* (53 percent), are the next most supported in 2023. New 12-month investment plans are strongest for *park MLib*, *Tensorflow*, *scikit-learn*, and *PyTorch*. Current support and future plans appear to align with user requirements (fig. 68).

Industry Support for Open-Source Analytical and Machine Learning Technologies

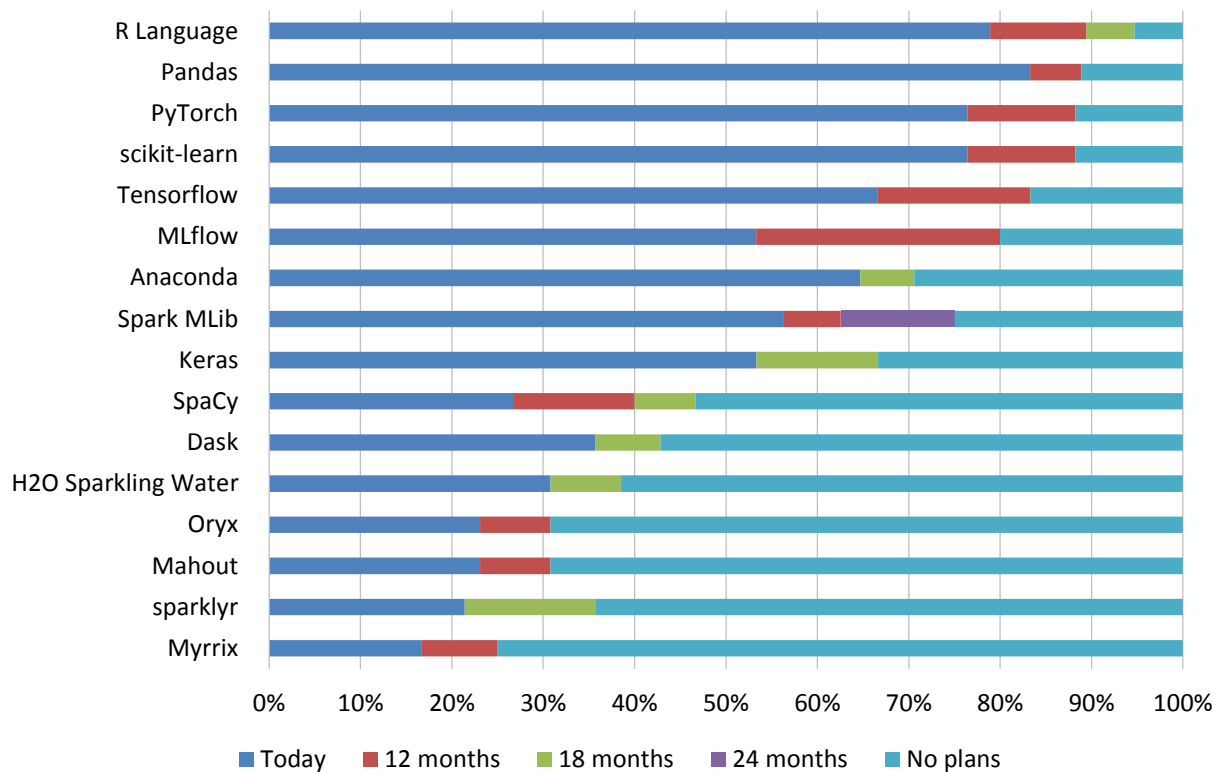


Figure 80 – Industry support for open-source analytics and machine learning technologies

2023 AI, Data Science, and Machine Learning Market Study

Industry Support for Analytical Data Sources

Our industry sample supports a broad range of analytical data sources in 2023, with current support highest for *Amazon Redshift* (94 percent), followed by *Snowflake*, *Mongo DB*, *Amazon S3*, and *Azure Data Lake Store* (all 83-86 percent) (fig. 81). The next most supported are *Amazon S3* (86 percent), *Hive/Hive QL* (85 percent), and *Spark SQL* (84 percent). All but five data sources are supported by more than half of our industry sample, and some sources are expected to gather significant investment in future time frames. (Also see user importance, fig. 69.)

Industry Support for Analytical Data Sources

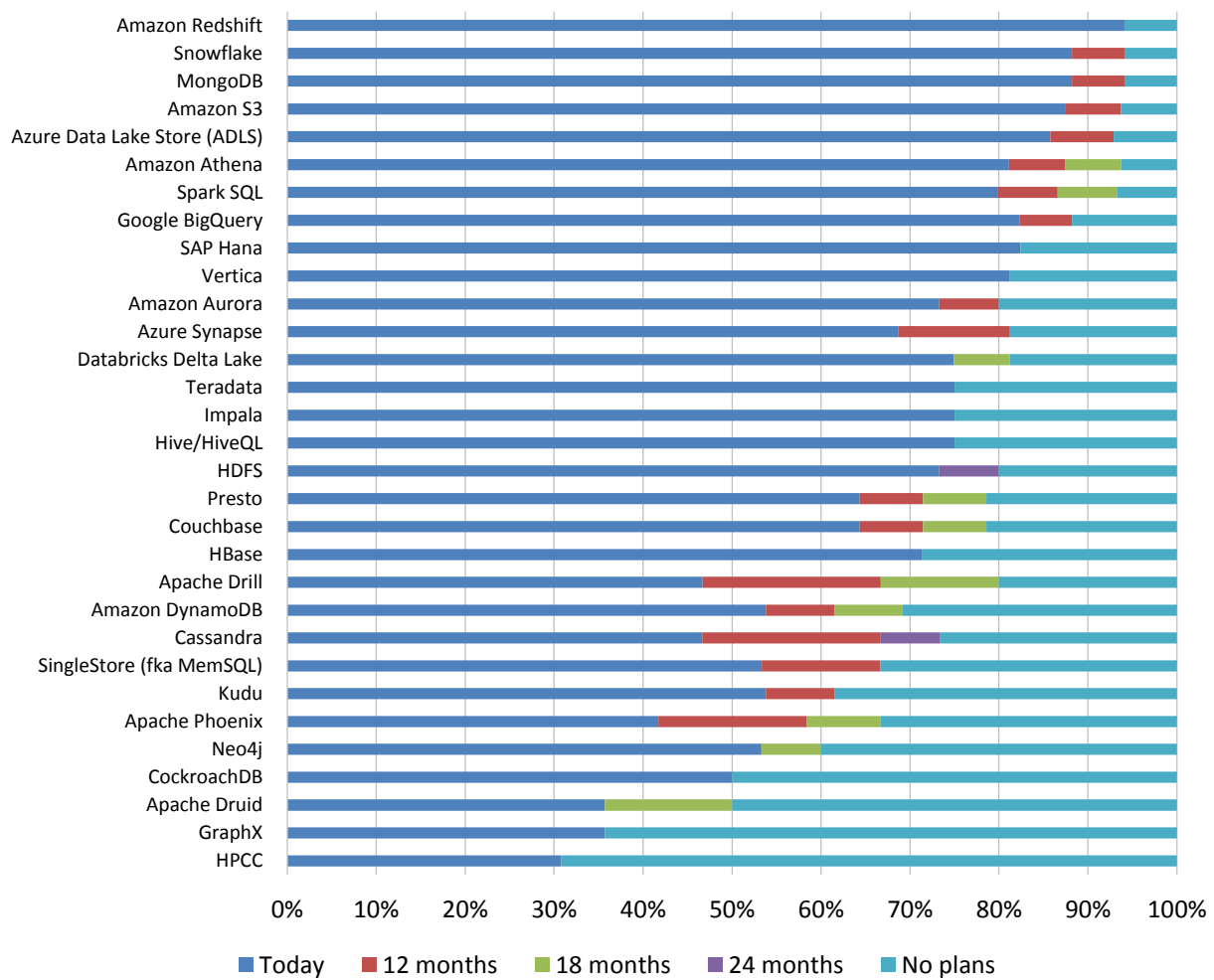


Figure 81 – Industry support for analytical data sources

AI, Data Science, and Machine Learning Vendor Ratings

In rating the vendors, we consider core features (including neural network support), data preparation, usability, scalability, integration, and support for big data / open-source technologies (fig. 86). To be ranked, we require a minimum score of 50 percent. It is important to scrutinize all rating categories and match vendor strengths to use cases and requirements. Top-ranked vendors include Dataiku (1st), DataRobot (1st), Domino Data Lab (1st), Palantir (1st), Google (2nd), SAS (2nd), Altair (3rd), TIBCO (4th), and Domo (5th).

AI, DS and ML Vendor Ratings

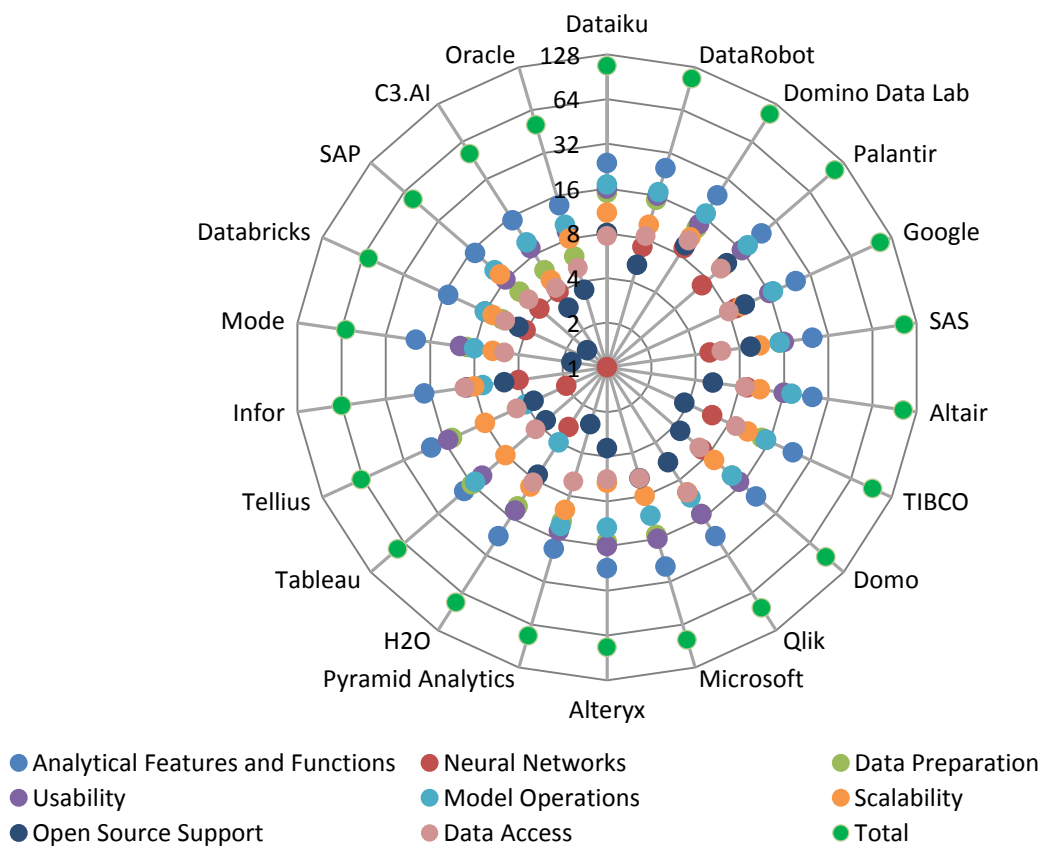


Figure 82 – AI, data science, and machine learning vendor ratings

Other Dresner Advisory Services Research Reports

- Wisdom of Crowds® “Flagship” Business Intelligence Market Study
- Analytical Data Infrastructure
- Analytical Platforms
- BI Competency Center
- Cloud Computing and Business Intelligence
- Data Catalog
- Data Engineering
- Data Governance
- Embedded Business Intelligence
- Enterprise Performance Management
- ESG Reporting
- Financial Consolidations, Close Management, and Financial Reporting
- Guided Analytics
- Master Data Management
- ModelOps
- Sales Performance Management
- Self-Service Business Intelligence
- Small and Mid-Sized Enterprise Business Intelligence
- Small and Mid-Sized Enterprise Performance Management
- Supply Chain Planning and Analysis
- Workforce Planning and Analysis

Appendix: AI, Data Science and Machine Learning Survey Instrument

Please enter your contact information below

First Name*: _____

Last Name*: _____

Title: _____

Company Name*: _____

Street Address: _____

City: _____

State: _____

Zip: _____

Country: _____

Email Address*: _____

Phone Number: _____

URL: _____

What major geography do you reside in?*

- North America
- Europe, Middle East and Africa
- Latin America
- Asia Pacific

Please identify your primary industry*

- Advertising
- Aerospace

2023 AI, Data Science, and Machine Learning Market Study

- () Agriculture
- () Apparel & accessories
- () Automotive
- () Aviation
- () Biotechnology
- () Broadcasting
- () Business services
- () Chemical
- () Construction
- () Consulting
- () Consumer products
- () Defense
- () Distribution & logistics
- () Education (Higher Ed)
- () Education (K-12)
- () Energy
- () Entertainment and leisure
- () Executive search
- () Federal government
- () Financial services
- () Food, beverage and tobacco
- () Healthcare
- () Hospitality
- () Insurance

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- Legal
- Manufacturing
- Mining
- Motion picture and video
- Not for profit
- Pharmaceuticals
- Publishing
- Real estate
- Retail & wholesale
- Sports
- State and local government
- Technology
- Telecommunications
- Transportation
- Utilities
- Other - Write In: _____

2023 AI, Data Science, and Machine Learning Market Study

How many employees does your company employ worldwide?

- 1 - 100
- 101 - 1,000
- 1,001 - 2,000
- 2,001 - 5,000
- 5,001 - 10,000
- More than 10,000

What function do you report into?*

- Business Intelligence Competency Center
- Executive management
- Faculty (Education)
- Finance
- Human resources
- Information Technology (IT)
- Manufacturing
- Marketing
- Medical staff (Healthcare)
- Operations
- Research and development (R&D)
- Sales
- Strategic planning function
- Supply chain
- Other - Write In: _____

2023 AI, Data Science, and Machine Learning Market Study

Does your organization use or intend to use data science and machine learning?

- Yes, we use data science and machine learning today in production
- Data science and machine learning is being used in very limited ways or as proof of concept
- We are currently evaluating data science and machine learning software
- No, we have no plans to use data science and machine learning at all
- We may use data science and machine learning in the future

What are your plans for AI, data science and machine learning in the future?

- Will Adopt this Year
- Will Adopt Next Year
- Will Adopt Beyond Next Year

How long have data science and machine learning been in use in your organization?

- Less than 1 year
- 1-2 years
- 2-3 years
- 3-5 years
- More than 5 years

Which kinds of users use (or will use) data science and machine learning within your organization?

	Constantly	Often	Occasionally	Rarely	Never
BI expert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2023 AI, Data Science, and Machine Learning Market Study

Business Analyst	()	()	()	()	()
"Citizen" Data Scientist	()	()	()	()	()
Executive	()	()	()	()	()
Financial Analyst	()	()	()	()	()
IT Staff	()	()	()	()	()
Marketing Analyst	()	()	()	()	()
Statistician / Data Scientist	()	()	()	()	()
Third-Party Consultant	()	()	()	()	()

How is data science and machine learning being used in your organization?

	Today	12 Months	24 Months	No Plans	Don't know
Churn Prevention	()	()	()	()	()
Cognitive Robotic Process Automation	()	()	()	()	()
Customer Lifetime	()	()	()	()	()

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Value					
Customer Segmentation	()	()	()	()	()
Demand Forecasting	()	()	()	()	()
Fraud Detection	()	()	()	()	()
Next Best Action	()	()	()	()	()
Predictive Maintenance	()	()	()	()	()
Price Optimization	()	()	()	()	()
Product Propensity	()	()	()	()	()
Quality Assurance	()	()	()	()	()
Risk Management	()	()	()	()	()
Up and Cross-Selling	()	()	()	()	()

Analytical Features: Which of the following features are important for AI, data science and machine learning?

	Critical	Very Important	Important	Somewhat Important	Not Important
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2023 AI, Data Science, and Machine Learning Market Study

Automatic feature selection like principal component analysis (PCA)	()	()	()	()	()
Text analytic functions and sentiment analysis	()	()	()	()	()
Various approaches to CART (e.g., ID3, C4.5, CHAID, MARS, random forests, gradient boosting)	()	()	()	()	()
Vector machine (SVM) approaches for classification and estimation	()	()	()	()	()
Neural networks supported	()	()	()	()	()
Geospatial analysis	()	()	()	()	()
Range of regression models, from linear, logistic to nonlinear	()	()	()	()	()
Recommendation engine included	()	()	()	()	()
Hierarchical clustering, expectation	()	()	()	()	()

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maximization, k-Means, and variants of self-organizing maps					
Textbook statistical functions for descriptive statistics	()	()	()	()	()
Bayesian methods, including Naïve Bayes and Bayesian Networks	()	()	()	()	()
Ensemble learning	()	()	()	()	()
Video analysis	()	()	()	()	()
Model management and governance	()	()	()	()	()
Auto ML	()	()	()	()	()
Model explainability	()	()	()	()	()
Graph analytics	()	()	()	()	()
Forecasting with model customization (ARIMA, ETS, STL)	()	()	()	()	()
Optimization (e.g., linear programming)	()	()	()	()	()

2023 AI, Data Science, and Machine Learning Market Study

Outlier detection	()	()	()	()	()
Cross correlation analysis	()	()	()	()	()
SHAP Importance	()	()	()	()	()
Statistical process control	()	()	()	()	()

Which types of neural networks are most important to your organization?

	Critical	Very Important	Important	Somewhat Important	Not Important	Don't Know
Artificial neural network	()	()	()	()	()	()
Convolutional neural networks	()	()	()	()	()	()
Long short-term memory	()	()	()	()	()	()
Recursive neural networks	()	()	()	()	()	()
Deep learning neural networks	()	()	()	()	()	()
Adversarial	()	()	()	()	()	()

2023 AI, Data Science, and Machine Learning Market Study

neural networks						
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Data Preparation: For AI, data science and machine learning, which data preparation capabilities are important?

	Critical	Very Important	Important	Somewhat Important	Not Important
Support for Cutting, Merging, and Replacing Values	()	()	()	()	()
Complex Filtering	()	()	()	()	()
Support for Data Type Conversions	()	()	()	()	()
Cleansing and Enriching Source Data	()	()	()	()	()
Detecting Duplicates or Outliers	()	()	()	()	()
Set Operations (e.g., joins, aggregations or pivot tables)	()	()	()	()	()
Data Flows for Multi-step Transformations	()	()	()	()	()
Data Lineage, Profiling and Quality	()	()	()	()	()

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Differential Privacy	()	()	()	()	()
Formula Scripting	()	()	()	()	()
Imbalanced Classes Handling / Data Synthesis	()	()	()	()	()
ML-Driven Data Prep Recommendations	()	()	()	()	()
Model Data Preprocessing (imputation, encoding, feature scaling, holdout, 5-fold CV)	()	()	()	()	()
Semi-structured Extraction and Manipulation	()	()	()	()	()
Text Analytics and Enrichment (e.g., sentiment analytics, key word extraction)	()	()	()	()	()
Binning	()	()	()	()	()

Usability: Which usability features are important for AI, data science and machine learning?

	Critical	Very Important	Important	Somewhat Important	Not Important
A specialist NOT	()	()	()	()	()

2023 AI, Data Science, and Machine Learning Market Study

required to create analytical models, test and run them					
Support/guidance in preparing data analytical models	()	()	()	()	()
Automatic creation of models from data	()	()	()	()	()
Fast cycle time for analysis with data preparation functions	()	()	()	()	()
Access to advanced analytics for predictive and temporal analysis	()	()	()	()	()
Support for easy iteration	()	()	()	()	()
Simple process for continuous modification of models	()	()	()	()	()
Pre-built drag-and -drop macros and tools from R that require no scripting or programming	()	()	()	()	()
Support for entire process in a single application/user	()	()	()	()	()

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interface					
Automatic feature creation and down-selection	()	()	()	()	()
Automatic model tuning and selection	()	()	()	()	()
Dynamic filtering and live data segmentation	()	()	()	()	()
Guided user experience (AppCues)	()	()	()	()	()
Low-code / no-code with the ability to modify pre-built modules (execution transparency)	()	()	()	()	()
Pre-built drag-and-drop Python modules that require no scripting or programming	()	()	()	()	()
Pre-built models for particular types of metrics and KPIs	()	()	()	()	()

Scalability: Which scalability features are important for AI, data science and machine learning?

2023 AI, Data Science, and Machine Learning Market Study

	Critical	Very Important	Important	Somewhat Important	Not Important
In-Memory Analytics	()	()	()	()	()
In-Database Analytics	()	()	()	()	()
In-Hadoop Analytics (on file system)	()	()	()	()	()
Optimized for MPP Architecture	()	()	()	()	()
Multi-tenant Cloud Services	()	()	()	()	()
PMML Support	()	()	()	()	()
Code Generation Supported (e.g., Java, C)	()	()	()	()	()
GPU Acceleration	()	()	()	()	()
Spark Support	()	()	()	()	()
Hybrid / Cloud Bursting	()	()	()	()	()
Horizontal	()	()	()	()	()

2023 AI, Data Science, and Machine Learning Market Study

Scaling					
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What is the importance of big data / open source technologies (e.g., Apache) and architecture as a part of your data science and machine learning strategies?

- Critical
- Very Important
- Important
- Somewhat Important
- Not Important

Which open source / big data infrastructure features are important for AI, data science and machine learning?

	Critical	Very Important	Important	Somewhat Important	Not Important
Spark	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Atlas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Knox Gateway	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kafka	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Confluent KSQL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flink	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Amazon Kinesis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Google	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2023 AI, Data Science, and Machine Learning Market Study

Dataflow					
Apache Ranger	()	()	()	()	()
Apache Sentry	()	()	()	()	()
Spark Structured Streaming	()	()	()	()	()
Apache Atlas	()	()	()	()	()
Azure Data Factory	()	()	()	()	()
Databricks	()	()	()	()	()
Elasticsearch	()	()	()	()	()

Which open source / big data deployment technologies are important for AI, data science and machine learning?

	Critical	Very Important	Important	Somewhat Important	Not Important
Microservices architecture	()	()	()	()	()
Kubernetes	()	()	()	()	()
Yarn	()	()	()	()	()
Mesos	()	()	()	()	()
Docker swarm	()	()	()	()	()
Nomad	()	()	()	()	()

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Consul	()	()	()	()	()
Etcad	()	()	()	()	()
Zookeeper	()	()	()	()	()
Zipkin	()	()	()	()	()
Prometheus	()	()	()	()	()
Grafana	()	()	()	()	()
FluentD	()	()	()	()	()
Akka	()	()	()	()	()

Which open source / big data statistical and machine learning technologies are important for AI, data science and machine learning?

	Critical	Very Important	Important	Somewhat Important	Not Important
Mahout	()	()	()	()	()
R Language	()	()	()	()	()
Oryx	()	()	()	()	()
Myrrix	()	()	()	()	()
Spark MLlib	()	()	()	()	()
scikit-learn	()	()	()	()	()
Tensorflow	()	()	()	()	()
MLflow	()	()	()	()	()

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PyTorch	()	()	()	()	()
Kubeflow	()	()	()	()	()
Pandas	()	()	()	()	()
Dask	()	()	()	()	()
Anaconda	()	()	()	()	()
H2O Sparkling Water	()	()	()	()	()
Keras	()	()	()	()	()
sparklyr	()	()	()	()	()
SpaCy	()	()	()	()	()

Which data sources are important for AI, data science and machine learning?

	Critical	Very Important	Important	Somewhat Important	Not Important
Google BigQuery	()	()	()	()	()
HBase	()	()	()	()	()
HDFS	()	()	()	()	()
Hive/HiveQL	()	()	()	()	()
Impala	()	()	()	()	()
MongoDB	()	()	()	()	()
Amazon	()	()	()	()	()

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Redshift					
Spark SQL	()	()	()	()	()
Couchbase	()	()	()	()	()
Cassandra	()	()	()	()	()
Amazon S3	()	()	()	()	()
Neo4j	()	()	()	()	()
Presto	()	()	()	()	()
Kudu	()	()	()	()	()
Amazon DynamoDB	()	()	()	()	()
Azure Data Lake Store (ADLS)	()	()	()	()	()
Apache Drill	()	()	()	()	()
SingleStore (fka MemSQL)	()	()	()	()	()
Snowflake	()	()	()	()	()
SAP Hana	()	()	()	()	()
Apache Phoenix	()	()	()	()	()
Vertica	()	()	()	()	()
Teradata	()	()	()	()	()
CockroachDB	()	()	()	()	()

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Apache Druid	()	()	()	()	()
HPCC	()	()	()	()	()
GraphX	()	()	()	()	()
Oracle Big Data	()	()	()	()	()
Amazon Athena	()	()	()	()	()
Amazon Aurora	()	()	()	()	()
Azure Synapse	()	()	()	()	()
Databricks Delta Lake	()	()	()	()	()