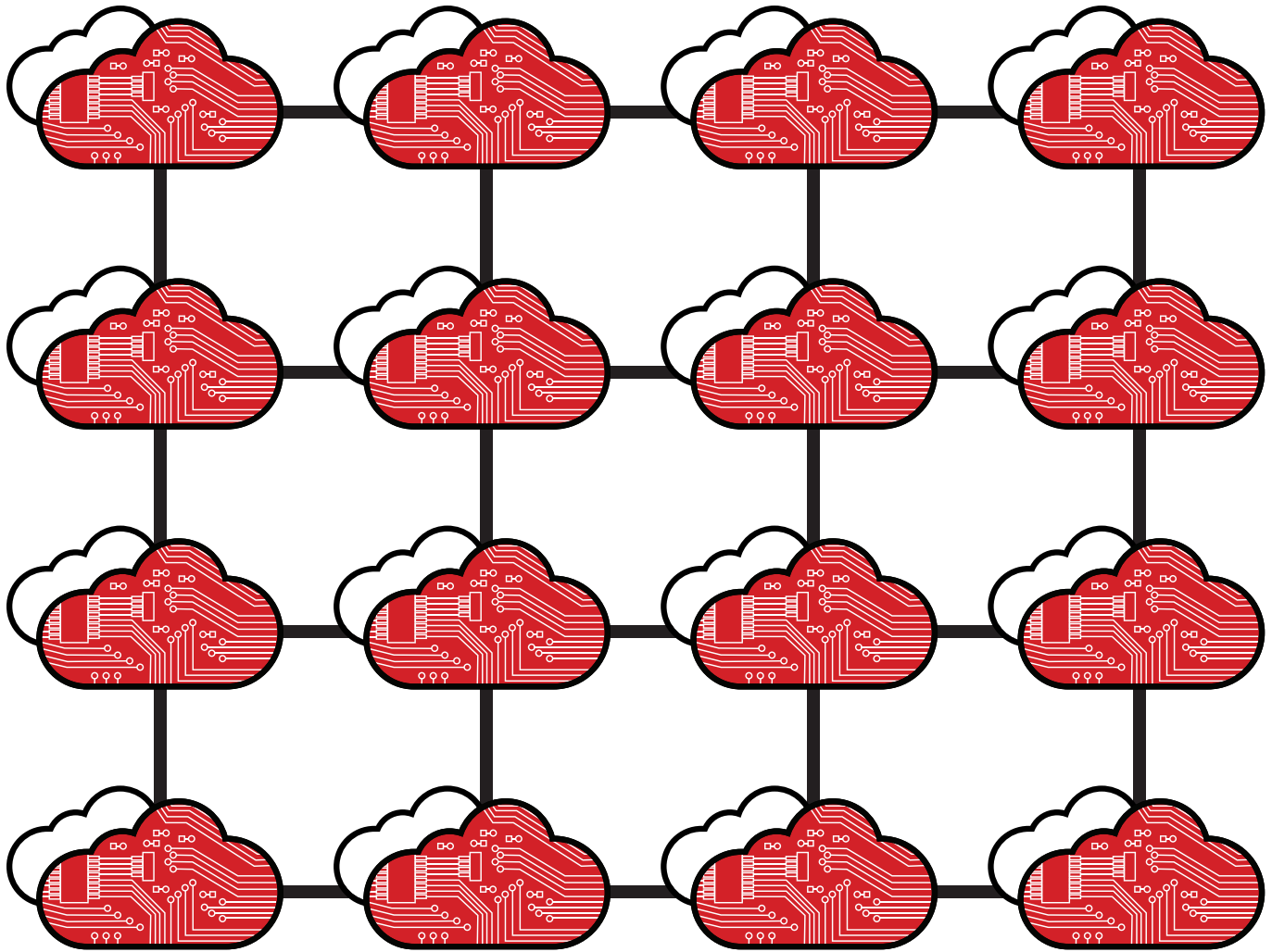# Trends in Data Management

A 2020 DATAVERSITY® Report

by **Donna Burbank** and **Michelle Knight**

OVALEDGE
Govern your data smartly

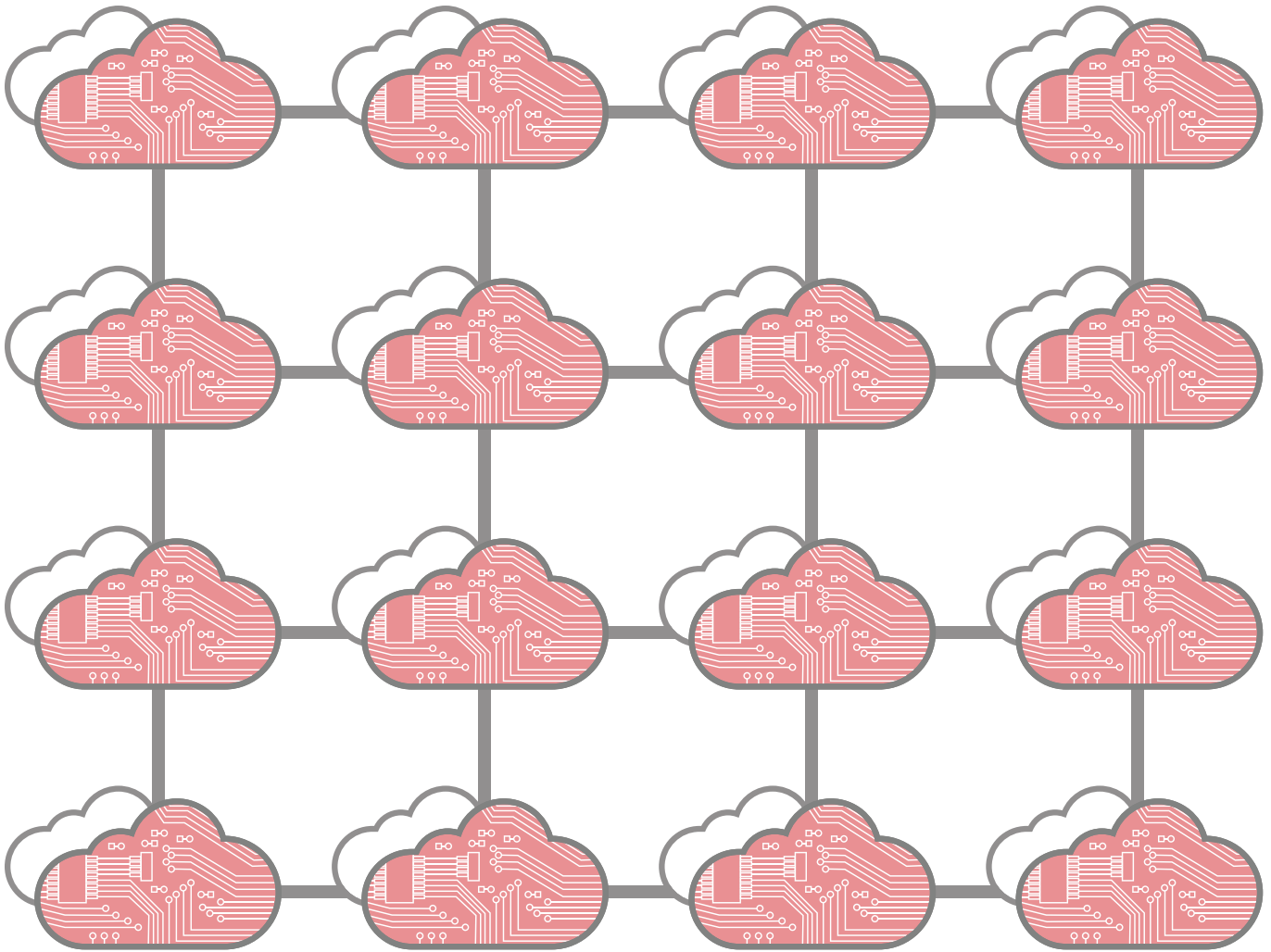Global Data Strategy
The Business of Data

DATAVERSITY®

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1. EXECUTIVE SUMMARY

The rise of the data-driven organization has been a growing trend over the past several years, and this trend has continued into 2020, as shown by the results of this DATAVERSITY® *Trends in Data Management 2020 Report*. However, with the number of issues plaguing 2020, including the COVID-19 crisis, organizations have tempered their plans for significant expansion, focusing on the core fundamentals of analytics, warehousing, and the associated architecture and governance that will help them gain a fuller understanding of their organization and the market in order to face the challenges ahead.

Despite these setbacks, Data Management is in a solid and arguably growth position as organizations look towards data to help them navigate the uncertain markets ahead. Digital transformation, which, again, had been growing in past years, was suddenly put at the forefront for many organizations looking to adapt to the changing COVID landscape and associated stay-at-home orders. Data Management is at the heart of digital transformation, and many organizations that had a solid data foundation in place were able to pivot quickly to adapt to the new and changing marketplace.

This year and the years ahead will likely continue to address these somewhat divergent aspects, i.e., innovative digital transformation and associated technologies, coupled with the Data Management fundamentals of governance, metadata, architecture and, in some cases, even the expansion of legacy technologies as explained in the Data Platforms Section of the paper.

The goal of this paper is to provide nuanced insight into the current and future plans of organizations in today's uncertain marketplace and how data will play a critical role in data-driven organization. How do companies practice Data Management in this environment? How will digital transformation play out in 2020 and into the future? What role will data fundamentals like governance, metadata, and architecture have in 2020 and beyond?

DATAVERSITY asked questions through the *2020 Trends in Data Management Survey*. This paper details and analyzes the survey's latest thoughts, trends, and activities indicated by study participants. Some findings include:

- Digital transformation is a key driver guiding broad Data Strategy and Data Management goals and activities. This trend has strengthened and will continue to do so:

    · 64.25% of respondents felt that supporting digital transformation was a main corporate goal, up 10.87% from the Trends in Data Management 2019 Report (TDM 2019).

    · 49.40% of respondents reported plans to implement Data Strategy, Data Architecture, and Data Governance, which were the top three responses for future implementation.

    · Between 2019 and 2020, respondents' plans substantially increased for Data Architecture (11.14%), Data Governance (10.51%), and Data Strategy (.25%)

- Organizations have committed to and will continue to grow core Data Management fundamentals to provide quality and time-sensitive information across the enterprise:

- 84.17% of those surveyed indicated either a Metadata Management program was in place or had plans for one in the future.

- 62.15% answered that Data Governance is in place or at the initial stages, which is an increase of 8.77% from the TDM 2019 report.

- 40.91% have a defined Data Architecture. This percentage increased by 8.33% from the result reported in the TDM 2019 report.

- Organizations have become more conservative in adopting emerging technologies, instead focusing on mature Data Management technologies providing business insights:

  - Relational on-premise and cloud database systems comprise the top data sources in use — 75.44% and 50.88%.

  - Through 2022, 54.17% plan on using relational cloud-based databases and 47.02% plan on using relational on-premise databases. From 2019, these jumped 2.67% and 8.20% respectively.

  - Planned implementation of digital twins, Industry 4.0, and smart spaces over the next one to two years declined significantly from the 2019 report.

This paper examines these results and provides insights into Data Management for the data-driven organization.

2. RESEARCH AND DEMOGRAPHICS

A. Scope of Research

The DATAVERSITY 2020 *Trends in Data Management Survey* provided insight into Data Management within a backdrop of digital transformation and the COVID-19 pandemic. The overall 2020 study structure, methodology, and questioning matched that of last year's *Trends in Data Management: A 2019 DATAVERSITY Report* to better understand how Data Management has evolved. Both 2020 and 2019 studies looked across the enterprise, including Data Modeling, Data Governance, Data Architecture, Big Data ecosystems, AI, and machine learning, and newer trends such as blockchain, edge computing, Industry 4.0, and digital twins.

The survey had 42 questions, and eight of these were open-ended for additional comments. This report will discuss those comments, when relevant, throughout the paper. The general demographics question did not have any further comments. Seven questions displayed only on the condition of a "yes" response to the previous question. The survey broke down into nine parts:

- General demographics (four questions).

- The Current State of Data Management (six questions, two open-ended).

- Goals, Drivers, and Training (six questions, three open-ended).

- Data Governance and Metadata Management (four questions, one conditional on a "yes" answer to having a Metadata Management effort in place, one open-ended question).

- Data Architecture (four questions, one conditional on having a defined Data Architecture foundation underlying Data Management goals and priorities, one open-ended).

- Data Modeling (four questions, two conditional on actively using Data Modeling, one open-ended question).

- Big Data Ecosystem Technologies (four questions, one conditional on using a Big Data platform, and one open-ended question).

- Data Platforms and Storage (six questions, two conditional on whether a cloud-based database was currently in use, and one open-ended question).

- New technologies and trends (four questions, including two open-ended).

DATAVERSITY recruited survey participants though an email campaign and Data Education Month resources. Respondents received links to the 2020 Trends in Data Management Survey and did not have a time limit on answering the questions. Participants did not receive compensation; however, after completing the questionnaire, they received compiled preliminary study results. The responses and conclusions within this paper represent the survey respondents only, a group predisposed to an interest in Data Management topics. A total of 294 participants from over 35 countries responded to the survey questions.

B. Principal Demographics

To begin, we asked respondents three main demographics questions (outside of contact information): job function, respondent's industry, and the number of employees in the respondent's company.

1. Job Function

The most significant percentages of those surveyed in 2020 (also in 2019) came from data-centric roles, such as Data Governance, Data Architecture, and Analytics and Business Intelligence. Compared to 2019, fewer with a marketing or market research background (-2.65%) took the survey in 2020. [Figure 1]:
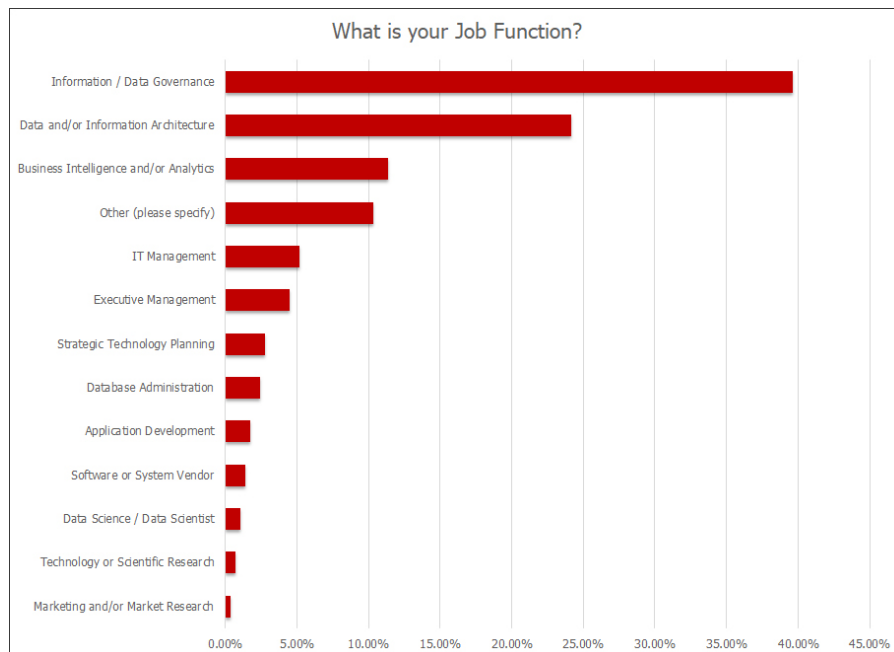

Figure 1: Job Function

The top three professions, in 2020, had the following results:

• Information/Data Governance: 39.66%

• Data and/or Information Architecture: 24.14%

• Business Intelligence and/or Analytics: 11.38%

Those identified as "Other" (10.34%) covered a few diverse areas, including scientific data publishing and institutional researcher.

2. Industry Representation

The 2020 study represented a wide range of about thirty industries, highlighting the continued democratization and widespread adoption of Data Management. In 2020, the majority worked in technology, finance, government, and healthcare — a combined 40.7%. These numbers were similar in 2019. [Figure 2]:
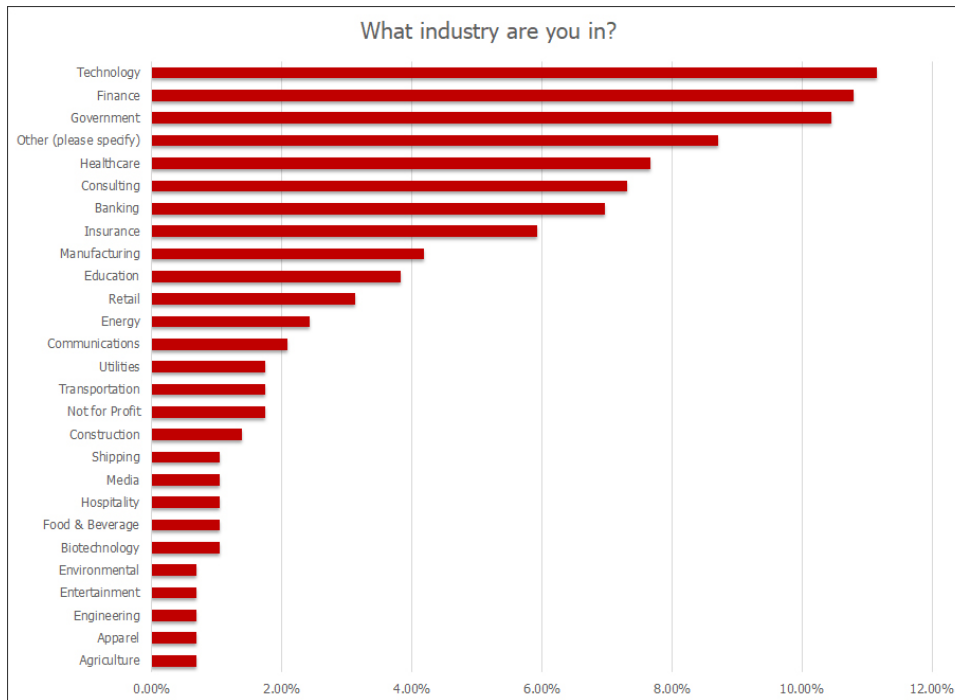
Figure 2: Industry

The top sectors broke down as follows:

- Technology: 11.15%

- Finance: 10.80%

- Government: 10.45%

- Healthcare: 7.67%

Other sectors represented included real estate, entertainment, museums, apparel, and human resources.
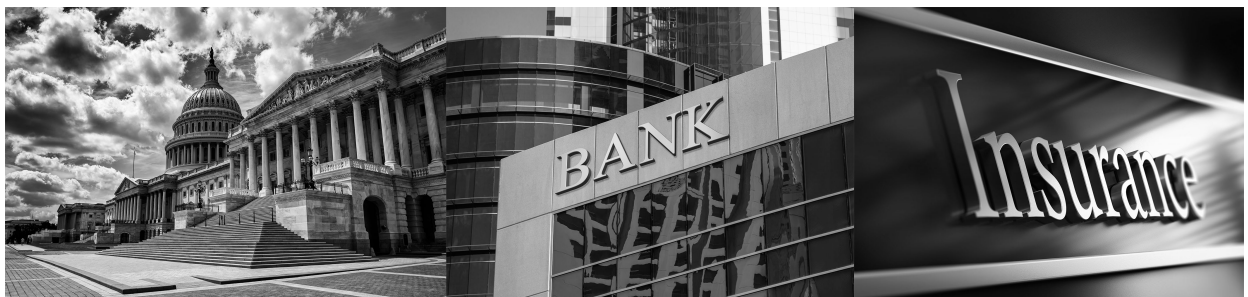
3. Company Size

Many survey participants came from large firms of 1000 employees and above (69.34%). [Figure 3]:
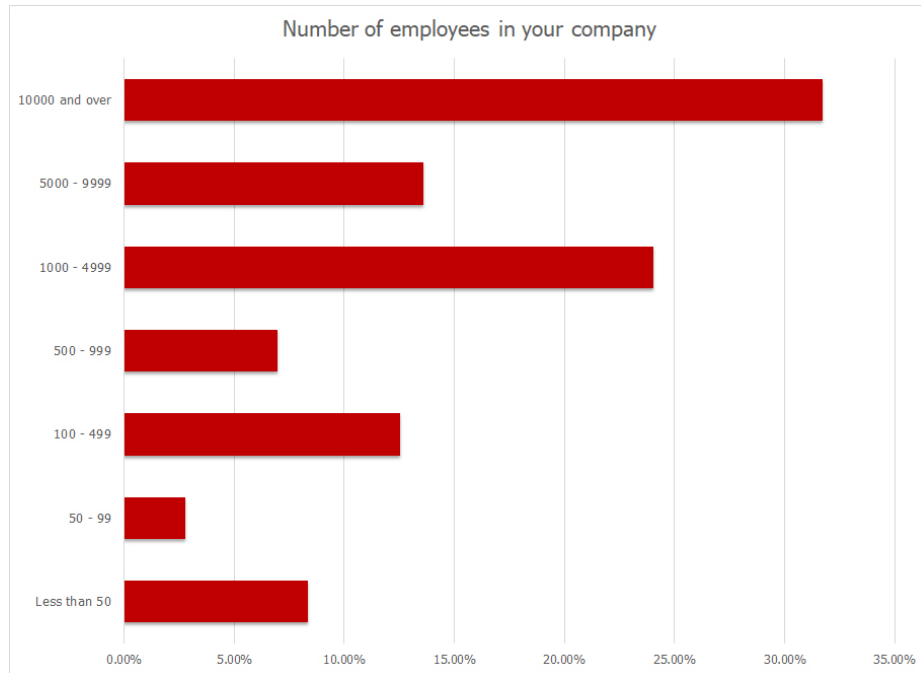
Figure 3: Number of Employees

The top four segments consisted of:

- 10,000 and over: 31.71%

- 1,000–4,999: 24.04%

- 5,000–9,999: 13.59%

- 100–499: 12.54%

3. INTRODUCTION: WHAT IS DATA MANAGEMENT?

A working description of Data Management is the DAMA International's definition in the Data Management Body of Knowledge (DAMA DMBoK), which is recognized as an industry standard. It says:

> "Data Management is the development, execution, and supervision of plans, policies, programs, and practices that deliver, control, protect, and enhance the value of data and information assets throughout their lifecycles."

Given such a broad concept, we wanted to know how survey respondents defined Data Management to understand the multiple perspectives, commonalities, and discrepancies of real-world data considerations. This survey asked the open-ended question:

- "What is your (or your organization's) definition of Data Management?"

Many responses pointed to the DAMA DMBoK definition. For those who provided a different meaning, notable quotes include:

- "Data Management provides quality and time-sensitive information to all business units to make decisions."

- "Data Management treats our data as a corporate asset so that it is reliable, protected, and the highest quality, enabling informed, accurate, and confident decisions."

- "Data Management spans mostly the technical side of Data Governance, including Data Modeling, Data Architecture, Data Quality, Data Integration, Metadata Management, and Master Data Management (MDM)."

- "Data Management describes a technology-enabled discipline in which business and IT work together to ensure the uniformity, accuracy, stewardship, semantic consistency, and accountability of the enterprise's official shared data assets."

All of these Data Management facets — driving timely business understanding, caring for data as an asset, and formally governing data along with technology — make up a successful Data Management program.

"
Data Management provides quality and time-sensitive information to all business units to make decisions.
"

4. THE CURRENT STATE OF DATA MANAGEMENT

To get a clearer picture of current Data Management practices and future trends, the survey asked three questions about Data Management's scope, roles, and plans within the organization.

A. Scope of Data Management

We asked the following question [Figure 4]:

▶ **"What is the scope of Data Management in your organization?"**
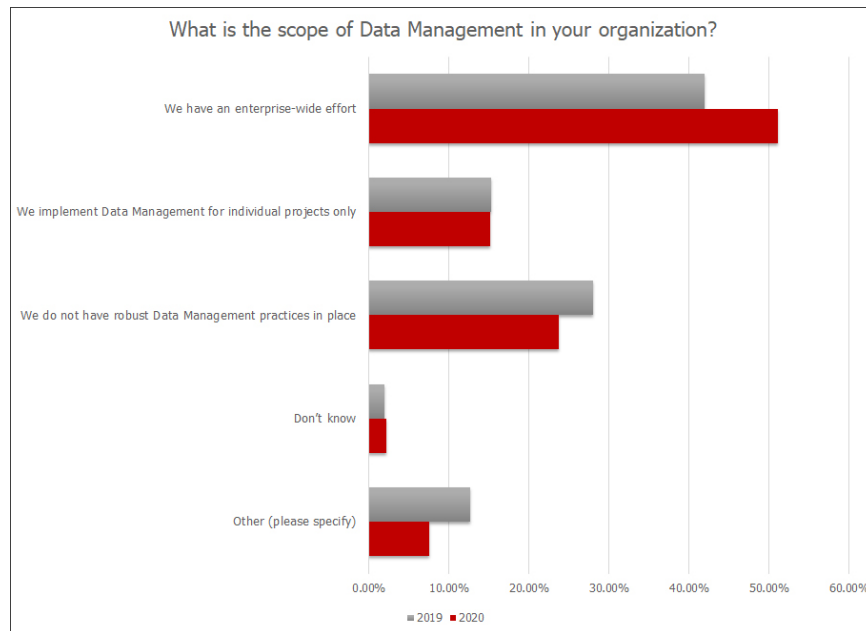
Figure 4: Scope of Data Management

The top responses for 2020 were:

• "We have an enterprise-wide effort": 51.12%

• "We do not have robust Data Management practices in place": 23.77%

Data from this question indicates a growing maturity in and acceptance of Data Management's importance in the marketplace.

Almost ten percent more respondents in 2020 (51.12%), as compared to 2019 (42.00%), answered having an enterprise-wide effort. Also, there was a decrease (- 4.23%) of respondents not having robust Data Management in 2020 (23.77%) than in 2019 (28.00%).

Comments further showed a growing scope of Data Management and its refinement across the broader organization. As one respondent noted:

- "I'd say we're somewhere between 'we have an enterprise-wide effort' AND 'we implement Data Management for individual projects only.' We have an overall effort, but consistently manage data as needed on a case-by-case basis."

B. Roles Driving Data Management

With the increased enterprise-wide Data Management focus, a wide range of roles have taken charge to drive the Data Management effort. We posed the following question to understand who is guiding and developing Data Management. [Figure 5]:

▶ **"Who is driving Data Management in your organization? [Select all that apply]"**
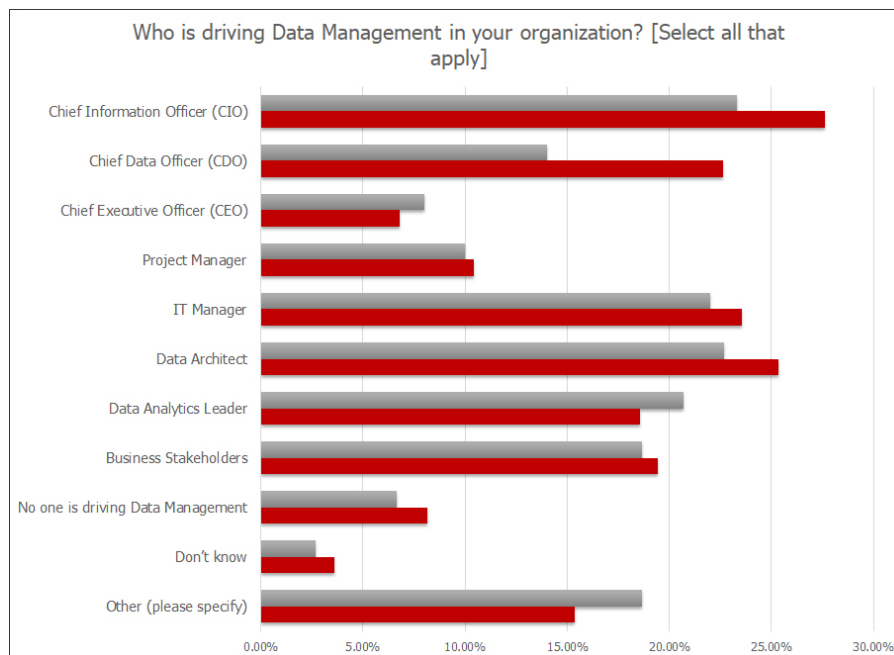

Figure 5: Who is Driving Data Management?

Top responses included:

- Chief Information Officer (CIO): 27.60%

- Data Architect: 25.34%

- Chief Data Officer (CDO): 22.62%

- Business Stakeholders: 19.46%

- Data Analytics Leader: 18.55%

A wide range of roles are involved in the typical Data Management initiative, this is a positive sign. Successful Data Management requires collaboration across multiple roles in both business and IT, often led by a Data Governance initiative, which, notably, was one of the top write-in responses.

The largest response was for Chief Information Officer (CIO), with the third largest being the Chief Data Officer (CDO), which showed a nearly ten percent (8.62%) increase, indicating the growing pervasiveness and importance of this role in the industry.

Also, heartening was the high number of C-level roles involved in Data Management, showing the growing importance of Data Management in the organization. Top responses included not only the CIO and CDO, but also the CEO, and a number of write-in responses were for C-level roles including, CFO, CAO, COO, CTO, Chief Risk Officer, and Chief Digital Officer.

C. Components of Data Management

Data Management spans various components across people, process, and technology. The survey asked which Data Management aspects respondents apply today. [Figure 6]:

► **"Which of the following have you already implemented in your organization? [Select all that apply]"**
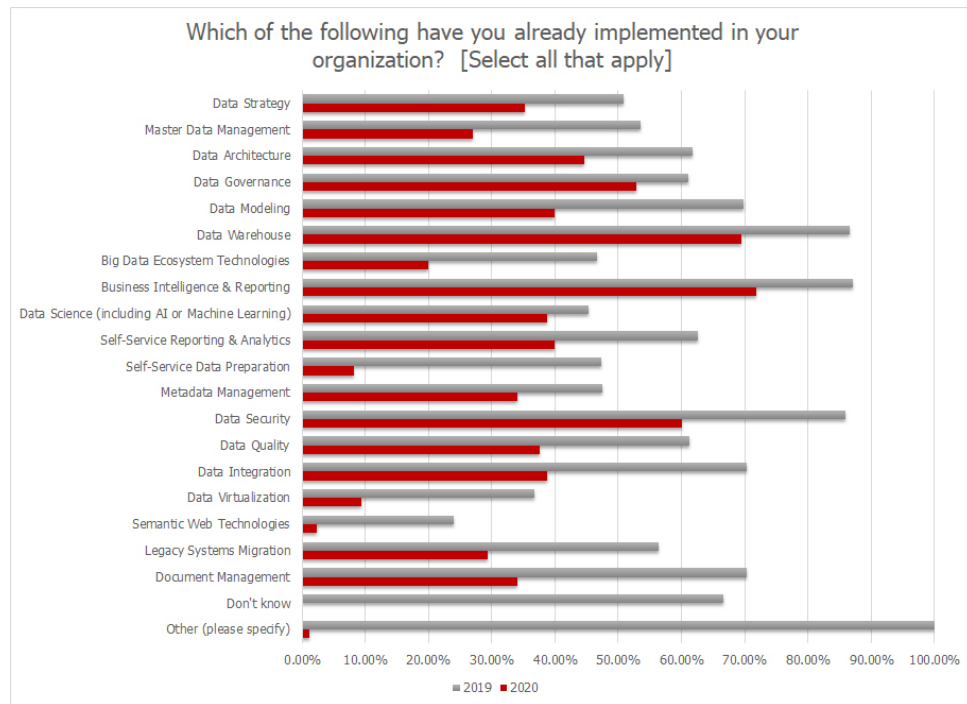

Figure 6: Current Implementation of Data Management

Top responses in 2020 included:

- Business Intelligence and Reporting: 71.76%

- Data Warehouse: 69.41%

- Data Security: 60.00%

Respondents also indicated they use reliable data foundational elements:

- Data Governance: 52.94%

- Data Architecture: 44.71%

Those surveyed least utilized the following:

- Semantic Web Technologies: 2.35%

- Self-Service Data Preparation: 8.24%

- Data Virtualization: 9.41%

- Big Data Ecosystem Technologies: 20%

Survey results continued to show organizational commitment in having a Data Management bedrock to support business insights, with restraint on using emerging technologies. We will find this theme echoed throughout the report.

Top responses emphasized Business Intelligence (BI) and Reporting, Data Warehousing, and Data Security, which demonstrates the high value of data as an asset and business analysis importance in 2020. This focus on gaining business knowledge carries over from 2019, where Business Intelligence (BI) and Reporting (87.02%), Data Warehousing (86.55%), and Data Security (85.95%) also saw high implementations. Moreover, plans for Data Warehousing increased by 9.44% from 2019 (13.45%) to 2020 (22.89%). This result indicates an even stronger preference toward a data-driven business with analytics and protection of data assets.

Self-Service Data Preparation showed the largest drop from 47.37% in 2019 to 8.24% in 2020 (-39.13%), indicating a disillusionment from business stakeholders, perhaps due to the complexity of data preparation and a desire to focus on the analysis and reporting rather than the data preparation itself.

Big Data Technologies also saw a significant drop from 46.58% in 2019 to 20.00% in 2020 (-26.58%), indicating a disillusionment with the promise of ease of analytics from Big Data platforms. Instead, there was an increased focus around the "back to basics" on a more curated data warehouse environment.

"
Big Data Technologies also saw a significant drop from 46.58% in 2019 to 20.00% in 2020 (-26.58%), indicating a disillusionment with the promise of ease of analytics from Big Data platforms. Instead, there was an increased focus around the "back to basics" on a more curated data warehouse environment.
"

We followed up with a survey question about implementation plans. [Figure 7]:

► **"Which of the following are you planning on implementing in your organization within the next 1-2 years? [Select all that apply]"**

Figure 7: Future Implementation of Data Management

Organizations plan on a substantial implementation of Data Management fundamentals between 2020 and 2021:

• Data Strategy: 49.40%

• Data Architecture: 49.40%

• Data Governance 49.40%

Plans for newer technologies have settled to the bottom of the priority list:

• Semantic Web Technologies: 6.02%

• Data Virtualization: 16.87%

• Legacy Systems Migration 19.28%

The top three initiatives in 2020 were Data Strategy, Data Architecture, and Data Governance. These results align with what we see from our conversations with clients and also indicates how closely the three are aligned in that a solid Data Strategy relies heavy on a solid Data Architectur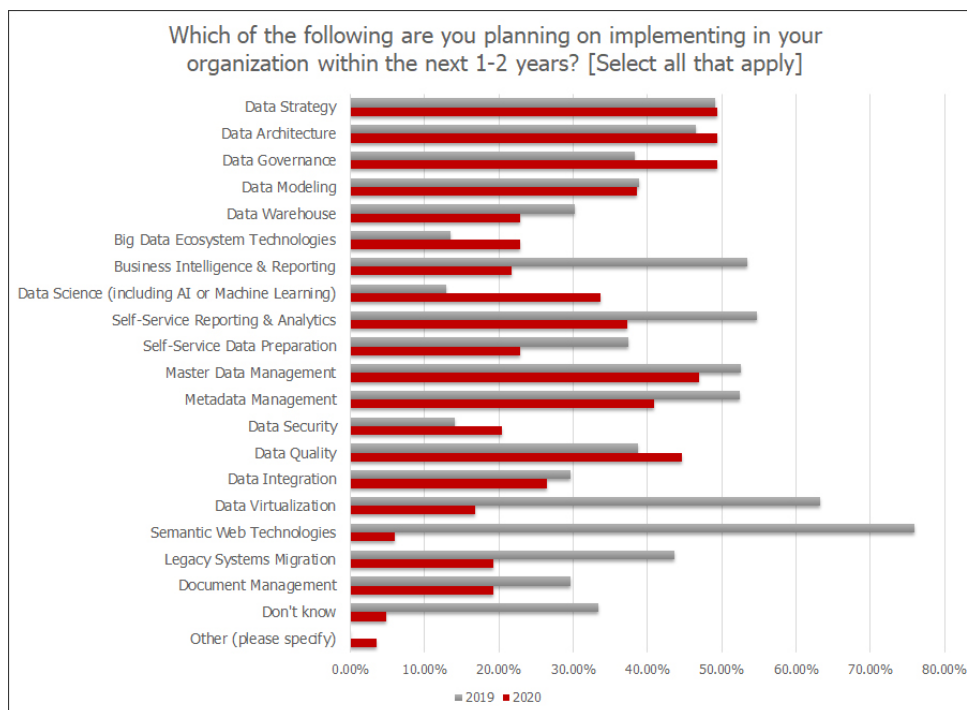e and Data Governance framework. Data Strategy as a leading initiative further shows the drive for a data-driven business and a continued business focus for using data for strategic advantage.

A notable finding is the percentage for future efforts dropped significantly across the board. This is likely in large part due to the COVID-19 pandemic and the fact that many organizations have put many initiatives on hold. Ironically, a higher percentage of organizations in 2020 were more certain about the future. In 2020, only 4.82% said they did not know about Data Management implementation plans in the next year or two, as compared to 33.33% in 2019 — a -28.51% change.

While the future of the economy is clearly uncertain for many, it is apparent that this uncertainly will lead to many projects being put on hold. The areas with the highest drop included: Semantic Web Technologies, Data Virtualization, Big Data Ecosystem Technologies, and Self-Service Data Preparation. With these significant drops, the increase in Data Strategy, Data Architecture, and Data Governance shows the critical role these initiatives play in an organization, as many look to have a stronger digital presence in coming months and years.

D. Concluding Comments

Organizations have a greater appreciation for Data Management and its fundamentals as a foundation for digital transformation and agility in new technologies. Respondents emphasized this motivation in the concluding comments:

- "Data Management, in a transitional stage, has matured significantly. Exciting emerging technologies drive towards changing business models and digitization."

- "Our business fully values information and data, but the lack of information technology maturity has been holding us back to fulfill all business requirements."

- "Data Management success requires technical and cross-functional collaboration."

- "Data Management requires personal discipline, a strong commitment to Data Governance, consistent training, and effective change management, not just tools, analytics, and technical guardrails. Everyone in the organization needs to participate in managing data effectively and undertaking this challenging journey."

Comments stressed that Data Management expectations and activities continue to evolve. It will be interesting to see how this trend develops in future reports.

"
Data Management requires personal discipline, a strong commitment to Data Governance, consistent training, and effective change management, not just tools, analytics, and technical guardrails. Everyone in the organization needs to participate in managing data effectively and undertaking this challenging journey.
"

5. GOALS, DRIVERS, AND TRAINING

In the previous section, survey questions and answers provided the shape of current Data Management practices and planned future implementations. Data Management developments show a commitment to digital transformation and a focus on becoming data driven. This section will build on these ideas by showing the currents and undercurrents patterning Data Management. This survey asked five questions about Data Management's goals, drivers, and training.

A. Goals and Drivers

The survey asked the following. [Figure 8]:

▶ **"What are your main business goals and drivers for implementing Data Management in your organization? [Select all that apply]"**
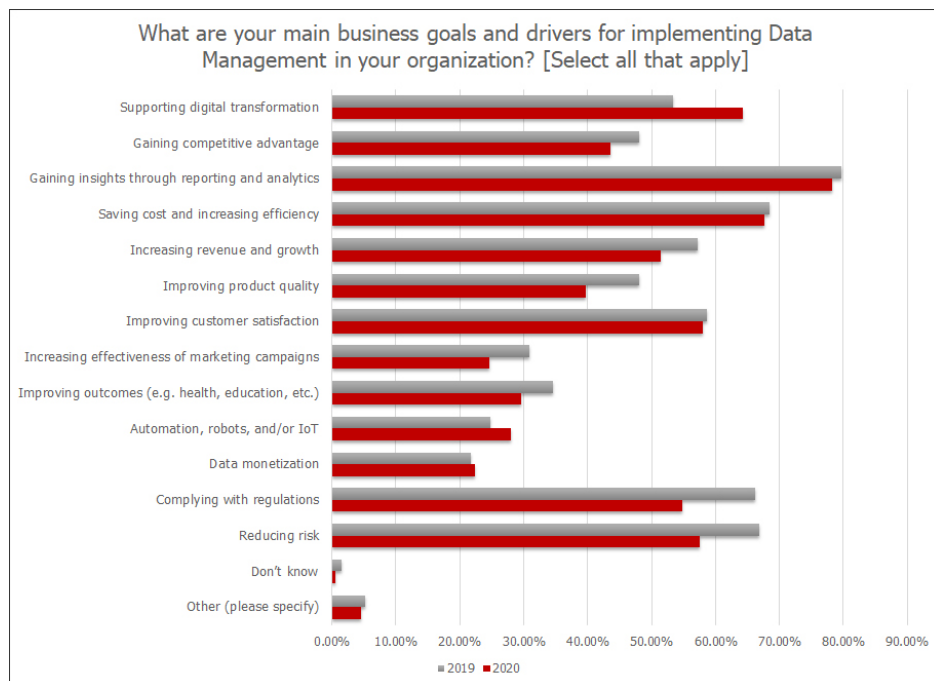

Figure 8: Main Business Goals and Drivers

The top three goals and drivers registered as follows:

- Gaining insights through reporting and analytics: 78.21%

- Saving cost and increasing efficiency: 67.60%

- Supporting digital transformation: 64.25%

Other popular choices included:

- Improving customer satisfaction: 58.10%

- Reducing risk: 57.54%

- Complying with regulations: 54.75%

Only 0.56% of those surveyed did not know the main business goals and drivers for implementing Data Management.

Survey responses show increased momentum for digital transformation in the Data Management world. "Gaining insights through reporting and analytics" and "saving cost and increasing efficiency" remained the top responses in 2019 (79.70% and 68.42%) and 2020 (78.21% and 67.60%). However, "supporting digital transformation" took the third-level spot in 2020 (64.25%), increasing 10.87% from 2019's 53.38%.

Risk reduction, chosen by 57.54% in 2020, dropped from its third-place status when 66.92% of survey respondents had chosen it in 2019, a decrease of -9.38%. That digital transformation outplaced reducing risk did seem reasonable. As we've seen in other areas of this survey, interest in digital transformation, which had been increasing over the past years, has seen a significant spike in 2020 due to in-person limitations as a result of the pandemic.

1. Priorities and Goals

How do survey participants see Data Management drivers in the future? To find out, we asked an open-ended question:

- "What are your top 2-3 Data Management priorities/goals for 2019-2020?"

Replies to this question indicated a keen interest in digital transformation:

- "We put monetization, in support of digital transformation, as the top goal."

- "We want to support digital transformation, become a data-driven organization, and improve the customer experience."

- "Digital transformation and education of staff represent our primary priorities."

Also, many participants emphasized the need to create a Data Strategy:

- "Data Strategy and Data Governance drive our Data Management."

- "We consider developing a digital Data Strategy and migrating to an off-the-shelf order system our top Data Management priorities."

- "We put executing our Data Strategy to put enterprise data in 'one place' and conforming it for multiple uses."

> *We are starting to focus on improving Data Quality. We want to improve Data Governance training and education to all staff in the organization.*

Other key themes from respondents homed in on Data Governance and Data Quality to support the data-driven business:

- "We want to improve Data Governance and standardize processes across teams."

- "Our Data Management goals consist of Data Quality and Data Governance."

- "We are starting to focus on improving Data Quality. We want to improve Data Governance training and education to all staff in the organization."

2. Challenges

Organizations certainly face difficulties in these uncertain times, driving Data Management goals. To understand this, we asked the open-ended question:

▶ **"What are the top 2-3 challenges you are facing with implementing Data Management?"**

Creating a data-driven culture and the need to increase collaboration and reduce silos are key themes as organizations look to support their Data Strategy and digital transformation. The lack of Data Management skills and resources is a limitation cited by many respondents.

Prominent responses included:

- "Our top challenge includes changing the culture to support critical data that is healthy and accessible (No, we do not have this support today.)"

- "We want to expand opportunities for stakeholder buy-in and organizational culture support for Data Management."

- "Business commitment, culture improvements, and Data Strategy represent our biggest challenges."

- "We are challenged by politics. We have tons of complex data and limited clarity on how best to bring it together."

Also, many of those surveyed listed a lack of Data Management skills and resources as significant frustrations:

- "Employee skill level and lack of data culture pose the biggest challenges for us."

- "The inertia of existing leadership and lack of skills to handle cloud technologies represent our biggest Data Management challenges."

- "Our top challenges are the lack of understanding of our fragmented Data Management and interest in sound Data Science. We struggle with existing practices to implement

> *Business commitment, culture improvements, and Data Strategy represent our biggest challenges.*

scientifically sound Data Management with limited resources: funding, positions, and competencies."

3. Tools and Technology

What about technology? How does it impact Data Management decisions? To learn this we asked [Figure 9]:

▶ **"How much has the selection and purchase of software tools impacted your Data Management implementation?"**
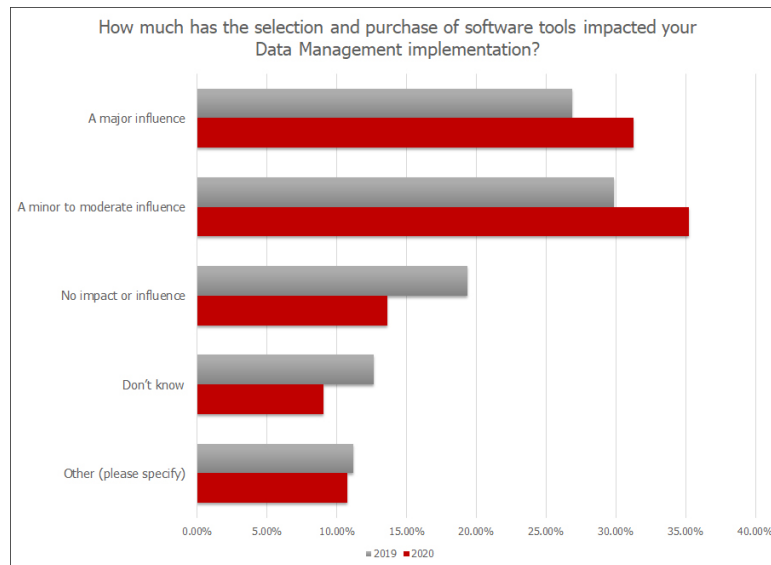
Figure 9: Software Tool Impact on Data Management Implementation

Software tools had some impact. Answers broke down as follows:

- A minor to moderate influence: 35.23%

- A major influence: 31.25%

- No impact or influence 13.64%

While software tools are an important part of Data Management, the majority of respondents focus first on Data Management fundamentals and best practices, rather than focusing primarily on a tool. The number of those stating "a minor to moderate influence" in 2020 (35.23%) increased 5.38% from 2019 (29.85%), signaling that software tools are playing a slightly diminishing part in developing Data Management.

" Our top challenges are the lack of understanding of our fragmented Data Management and interest in sound Data Science. We struggle with existing practices to implement scientifically sound Data Management with limited resources: funding, positions, and competencies. "

Many respondents indicated that the high cost of current tools is an obstacle to purchase:

- "We are often blocked by the high price of tools, especially when there is no subscription option. For example, the best data catalogs are ridiculously expensive and well beyond our budget for implementation, so we are still relying on homegrown versions."

- "The cost of an appropriate Data Quality suite is an obstacle."

- "Getting the investment panels to free money for Data Management is an on-going issue due to the difficulty in proving tangible benefits to the organization."

B. Training

How do participants educate themselves about Data Management and feel about their learning experience? This survey posed the question:

▶ **"What type(s) of training have you received in Data Management? [Select all that apply]"**

Survey participants cited a wide variety of sources, a necessity in today's ever-changing marketplace. [Figure 10]:
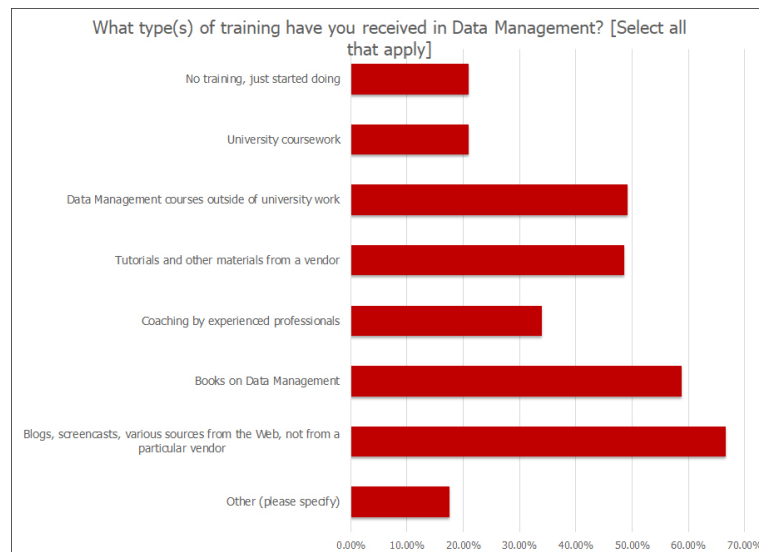

Figure 10: Training in Data Management

Top responses included learning from:

- Blogs, screencasts, various sources from the Web, not from a particular vendor: 66.67%.

- Books on Data Management: 58.76%.

While many survey participants used a wide range of resources, books continue to be a popular option in 2020, with 58.76% using them — although respondents indicated that they use books less (-4.67%) than they did in 2019 (63.43%). Perhaps the familiar structure of a book with the free availability from most public libraries made the book more attractive.

Some survey participants mentioned gaining training through industry certification (e.g., preparing for the Certified Data Management Practitioners or CDMP exam). It will be interesting to see how and to what extent Data Management training becomes standardized.

C. Concluding Comments

Concluding comments mentioned several themes. First, everyone needs to continually advance their skills:

- "Data Management, as a discipline, continues to evolve, meaning employees need frequent training to update their skills."

- "Training is the foundation of cultural change to adapt to Data Management."

Second, executive and practitioners need training:

- "Training top executives in Data Management concepts poses a problem."

- "Business and IT Data Management knowledge need improvement."

Finally, most training is done externally and not within the organization:

- "All training was received outside of this company. Senior leaders have little value or understanding about Data Governance, other than for compliance."

- "Companies do not seem to want to spend money on training. They prefer to have users spend tons of hours and money to piece data back together to save a dime today."

> "
> *Data Management, as a discipline, continues to evolve, meaning employees need frequent training to update their skills.*
> "

6. DATA GOVERNANCE AND METADATA MANAGEMENT

In the earlier sections, those surveyed indicated a higher value of Data Management fundamentals, including Data Governance and its supporting practices, such as Metadata Management. In this section, we posed three questions to go deeper into Data Governance and Metadata Management across organizations.

For those that answered "yes" to having a Metadata Management initiative, survey questions asked further details on how organizations administered their metadata assets.

A. Data Governance

We wished to better understand how organizations formally practice and process data assets. We asked respondents:

▶ **"Which of the following best represents your company's state of Data Governance?"**

Most organizations have some Data Governance at initial stages. [Figure 11]:
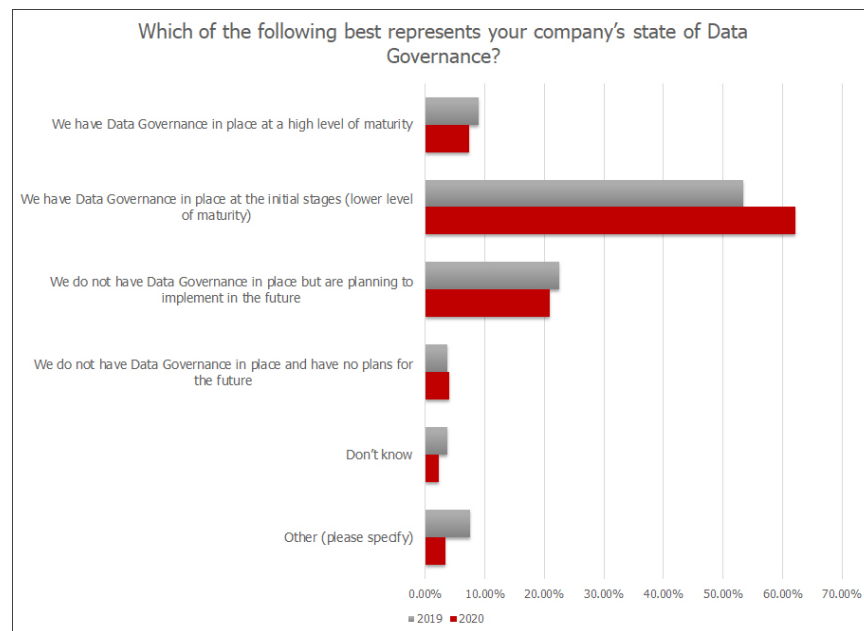

Figure 11: State of Data Governance

The responses broke down as follows, for 2020:

• Data Governance is in place at the initial stages (lower level of maturity): 62.15%.

• No Data Governance in place but a plan to implement in the future: 20.90%.

• Data Governance at a high level of maturity: 7.34%.

• No Data Governance program in place nor any plans in the future: 3.95%.

The number of organizations in early stages of launching Data Governance programs increased significantly by 8.77% between 2019 (53.38%) and 2020 (62.15%). However, fewer respondents (-1.68%) considered their Data Governance initiatives at a high level of maturity between 2019 (9.02%) and 2020 (7.34%).

Respondents added:

- "Data Governance maturity spans multiple stages across the organization."

- "We have more Data Governance maturity than those in 'initial stages,' but I cannot call this a 'high level of maturity' until the implementation of more Date Governance policies statewide."

Many organizations have a Data Governance program in motion; however, few have a high Data Governance maturity.

B. Metadata Management

Metadata, or data in context, fuels Data Governance, Data Analytics, and other key Data Management disciplines. We wanted to know whether organizations were managing metadata and asked the following. [Figure 12]:

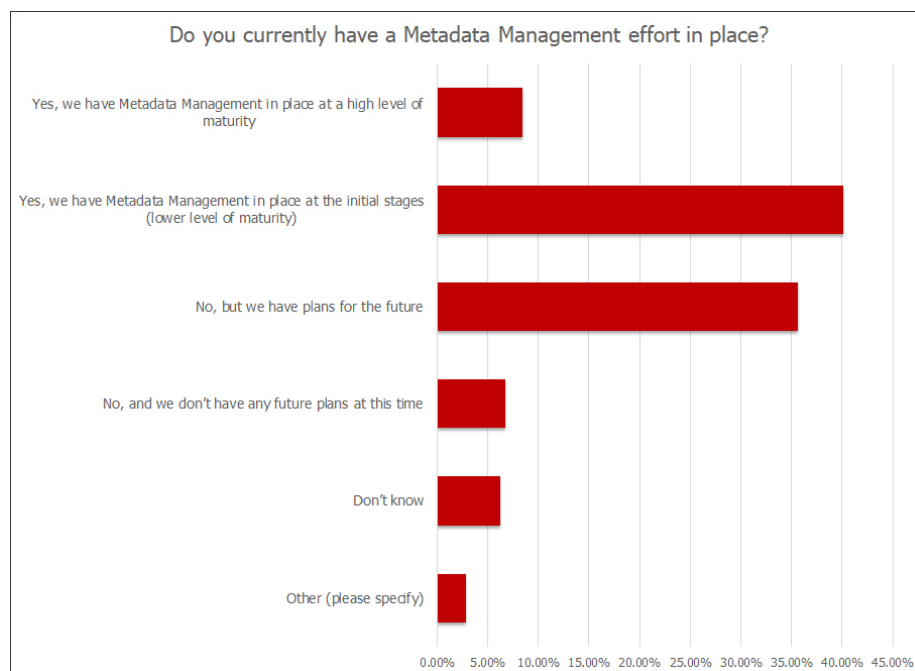▶ **"Do you currently have a Metadata Management effort in place?"**

Figure 12: Metadata Management Efforts in Place

The numbers show a strong drive for Metadata Management:

- Yes, we have Metadata Management in place at the initial stages (lower level of maturity): 40.11%.

- No, but we have plans for the future: 35.59%.

- Yes, we have Metadata Management in a place at a high level of maturity: 8.47%

Metadata Management continues to be a prevalent trend with 84.17% of respondents indicating that they currently had a metadata initiative in place or had plans for future efforts. This is in large part due to the fact that metadata supports a number of the key drivers that are growing in 2020 and beyond, such as Data Governance and Data Strategy. Many organizations are new to Metadata Management as is seen in 40.11% of respondents in the initial stages and 35.59% with plans for the future. Only 8.47% felt that their current Metadata Management efforts were at a high level of maturity.

For those organizations that said "yes" to having Metadata Management, we posed an additional query. [Figure 13]:

▶ **"What are your current main use cases for Metadata Management? [Select all that apply]"**
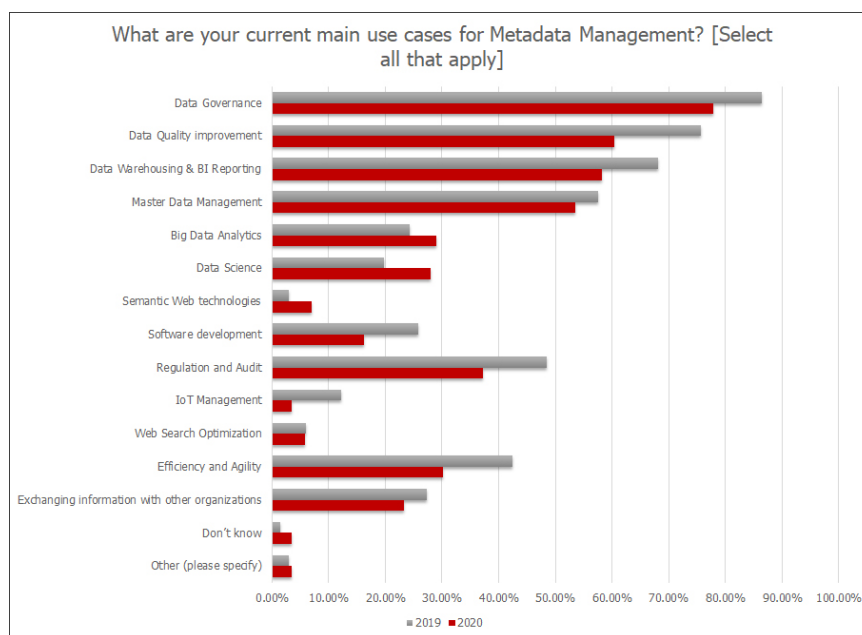

Figure 13: Metadata Management Use Cases

The top three Metadata Management use cases were:

- Data Governance: 77.91%

- Data Quality Improvement: 60.47%

- Data Warehousing & BI reporting: 58.14%

Metadata Management use cases apply least to the following:

- Web Search Optimization: 5.81%

- IoT Management: 3.49%

Results match the desire to advance data-driven capabilities and digital transformation across the organization. Respondents cited Data Governance, Data Quality improvement, and Data Warehousing and BI Reporting as top Metadata Management use cases. These 2020 results reflected the strong trends in 2019. Data Governance (86.36%), Data Quality improvement (75.76%), and Data Warehousing and BI Reporting (68.18%) took the primary roles in 2019 in driving Metadata Management.

C. Concluding Comments

Many organizations place increasing value on Data Governance and Metadata Management, and see these initiatives as essential for successful digital transformation. Some key comments include:

- "Our 2019 digital transformation projects led to implementing Data Governance, Metadata Management, and Master Data Management this year."

- "We focus on Data Governance and Metadata Management to build a data landscape informing us about all the data available."

However, achieving a high degree of organizational maturity for Data Governance and Metadata Management to succeed has posed some difficulties:

- "We see Data Governance and Metadata Management as necessary to succeed as a global company. But some groups in the company resist the changes that go along with Data Governance and Metadata Management. We are working through this challenge."

- "Data Governance and Metadata Management causes more perspiration than inspiration, discouraging people from them."

"
We see Data Governance and Metadata Management as necessary to succeed as a global company. But some groups in the company resist the changes that go along with Data Governance and Metadata Management. We are working through this challenge.
"

7. DATA ARCHITECTURE

Data Architecture, a pillar of digital transformation, connects business strategy and technical execution.

We wanted to know if organizations had a Data Architecture supporting their Data Management objectives. For those who did, we probed further to find its value and the problems companies face. We asked a total of three Data Architecture questions in the survey.

A. State of Data Architecture within Data Management

We wanted to comprehend Data Architecture's role in Data Management and asked survey participants the following:

▶ **"Does your organization have a defined Data Architecture foundation underlying your Data Management goals and priorities?"**

Many organizations have a defined Data Architecture. Survey results show the following [Figure 14]:
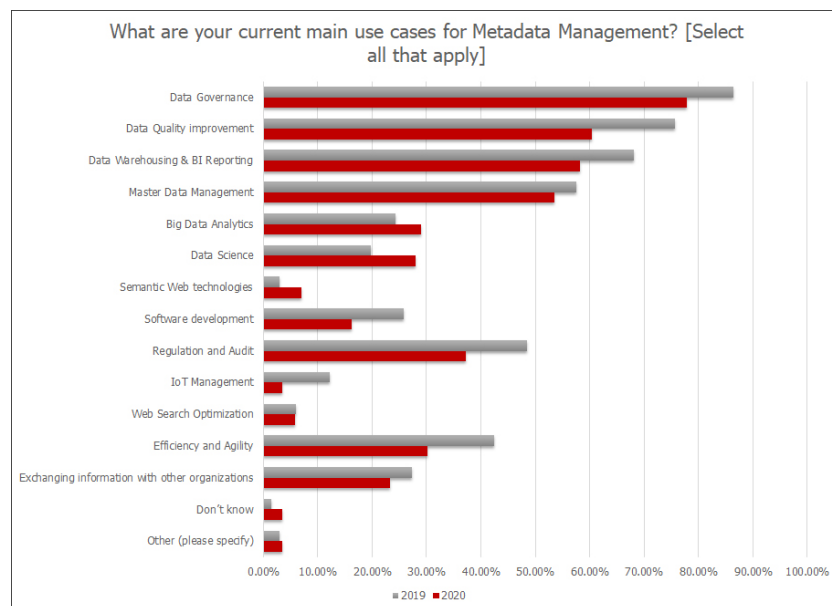
Figure 14: Data Architecture Foundation

Top results, for 2020, listed as follows:

• Do have a defined Data Architecture: 40.91%

• Do not have a defined Data Architecture: 32.39%

The number of organizations using a defined Data Architecture jumped 8.33%. Only 32.58% in the 2019 survey said they had established a Data Architecture foundation compared to 2020 at 40.91%. Also, those stating they do not have a defined Data Architecture declined 7.00% between 2019 (39.39%) and 2020 (32.39%).

Preference toward a defined Data Architecture coincides with data about what organizations have already implemented and what they plan on using. In 2020, 44.71% said they implemented Data Architecture [Figure 6] and 40.47% planned on implementing Data Architecture in the next one to two years. As mentioned earlier in the report, anticipated Data Architecture implementation rose 11.14% between 2019 and 2020.

Many respondents commented further that Data Architecture remained a work in progress from an early stage of implementation.

- "We are beginning to work on Data Architecture and Data Strategy as the first step towards a Data Management foundation."
- "The data and analytics department has a defined Data Architecture foundation, while Data Architecture remains a new role/focus across the organization."

B. Value of Data Architecture

Of those organizations with a Data Architecture supporting their Data Management, we wanted to know what value they were receiving. Participants were asked [Figure 15]:

▶ **"How has using a defined Data Architecture helped your organization? [Select all that apply]"**
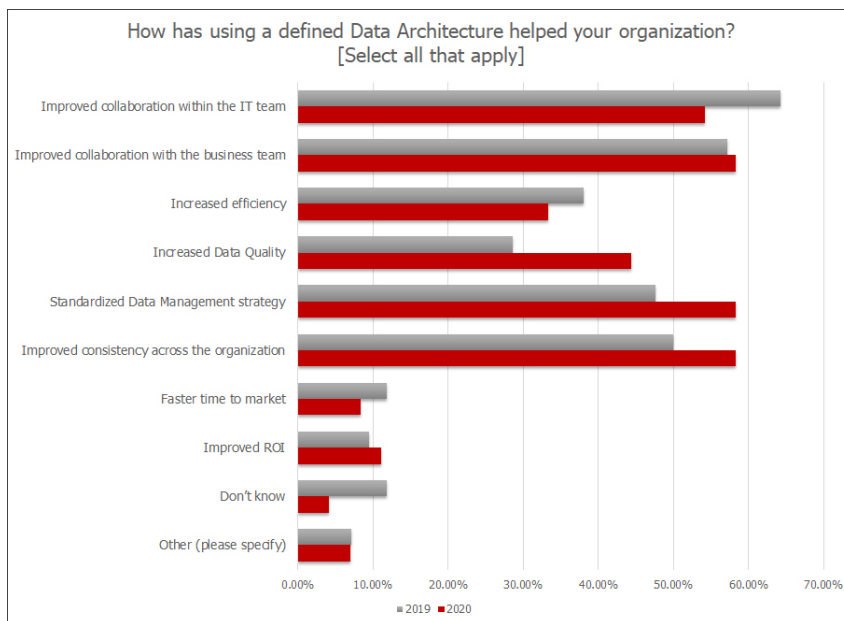

Figure 15: Data Architecture Advantages

"
We are beginning to work on Data Architecture and Data Strategy as the first step towards a Data Management foundation.
"

The percentages broke down as follows:

- Improved collaboration with the business team: 58.33%

- Standardized Data Management strategy: 58.33%

- Improved consistency across the organization: 58.33%

The top benefits in 2020 have corresponded greatly with those in 2019. Improved collaboration with the business team increased 1.19% between 2019 (57.14%) to 2020 (58.33%). Standardized Data Management strategy also rose significantly by 10.71% from 2019 (47.62%) to 2020 (58.33%). The value of Data Architecture's improved consistency across the organization went up 8.33% between 2019 (50.00%) to 2020 (58.33%)

Data Quality showed the most significant increase of 15.87% between 2019 (28.57%) and 2020 (44.44%). This result suggests that Data Architecture provides a business tool to advocate for and communicate about Data Quality.

In 2019, 64.29% of participants saw improved collaboration with the IT team as a benefit. While this is largely consistent with the results from the previous year, 2020 saw a decrease (-10.12%) to 54.17% in collaboration with the IT team, indicating that business users are often stronger proponents of architecture than the IT team themselves.

C. Challenges

Data Architecture faces roadblocks in its conception and implementation. To understand how this affects the organization, we asked the following [Figure 16]:

▶ **"What are your top Data Architecture challenges? [Select all that apply]"**
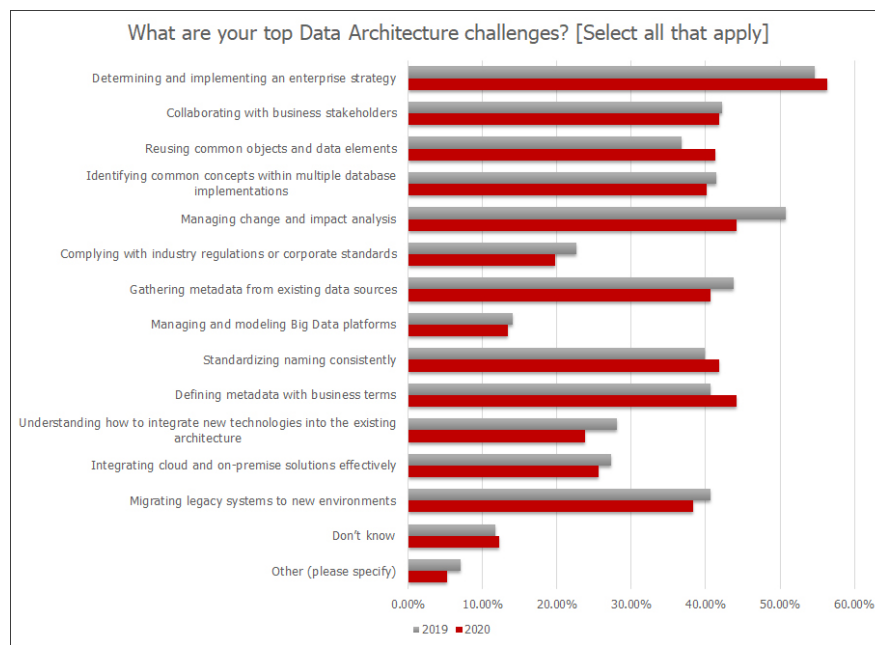

Figure 16: Data Architecture Challenges

The top three challenges were:

- Determining and implementing an enterprise strategy: 56.40%

- Managing change and impact analysis: 44.19%

- Defining metadata with business terms: 44.19%

Getting Data Strategy right remains a top Data Architecture challenge. In 2020, 56.40% of those surveyed chose "determining and implementing an enterprise strategy," a slight increase of 1.71% from 2019 responses (54.69%). As we saw in Figure 7, participants chose Data Strategy implementation as a very high priority for future implementation from 2020 to 2022 (49.40%).

Other Data Architecture difficulties experienced by organizations centered around understanding and using data terms. Managing change and impact analysis (44.19%) and defining metadata with business terms (44.19%) represent the second most pressing Data Architecture challenges in 2020. In 2020, 41.28% mentioned reusing common objects and data elements, a 4.56% increase from 2019 (36.72%). These results suggest organizational struggle understanding existing data contexts and how to apply data on-hand to changing business environments.

C. Concluding Comments

Participants indicated they would like Data Architecture to mature with better allocation of resources. One person stated:

- "We lack funding, people (capacity), fixed teams with long term governance, and management support. There is a lack of understanding about what Data Architecture means."

"
We lack funding, people (capacity), fixed teams with long term governance, and management support. There is a lack of understanding about what Data Architecture means
"

8. DATA MODELING

Data Modeling, the documenting the core business rules and definitions around data, plays a critical role in Data Management. To understand more, we asked three questions about Data Modeling activities in the organization. Further comments provided insight into Data Management, Data Modeling, and business alignment.

A. State of Data Modeling within Data Management

We posed the following question. [Figure 17]:

▶ **"Is your organization actively using Data Modeling?"**
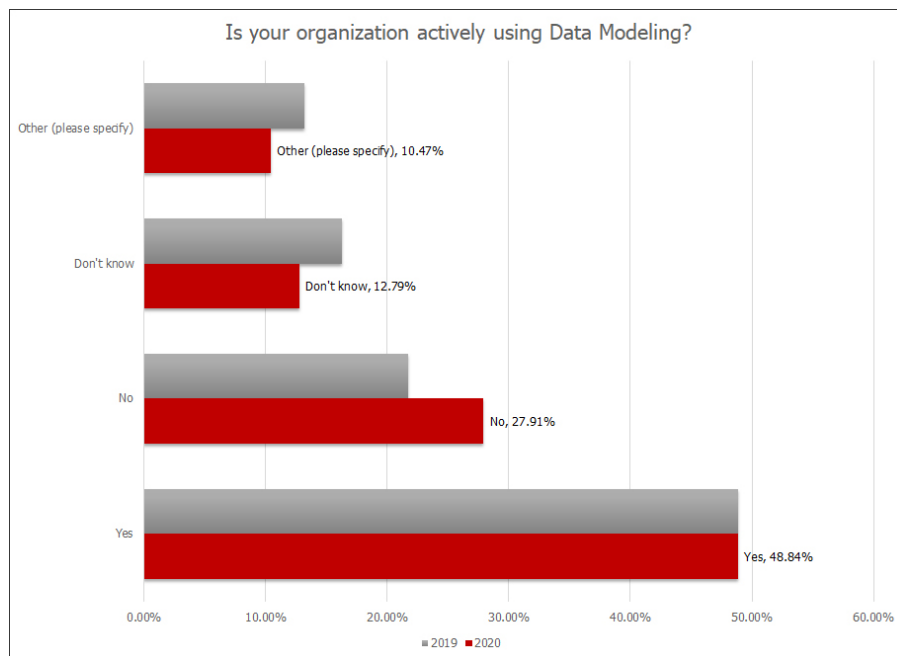
Figure 17: Actively Using Data Modeling

Top responses in 2020 were as follows:

- Yes, actively using Data Modeling: 48.84%

- No, not actively using Data Modeling: 27.91%

Data Modeling activities continue to have substantial value, as 48.84% of respondents chose "yes" in 2019 and 2020. However, consistent organization-wide Data Modeling continues to challenge companies. Respondents added the following comments:

- "Yes, we are using Data Modeling for some subjects, but we need to do more."

- "We do Data Modeling on a project basis."

B. Data Modeling Methods

For organizations that said they were using Data Models, this study wanted to know their methods and model types. So, we asked the question [Figure 18]:

► **"What methods of Data Modeling do you use in your organization? [Select all that apply]"**

Figure 18: Data Modeling Methods

The highest-ranking Data Modeling methods, for 2020, included:

• E-R/Relational: 57.14%

• Kimball-style Data Warehouse (aka Star Schema): 39.05%
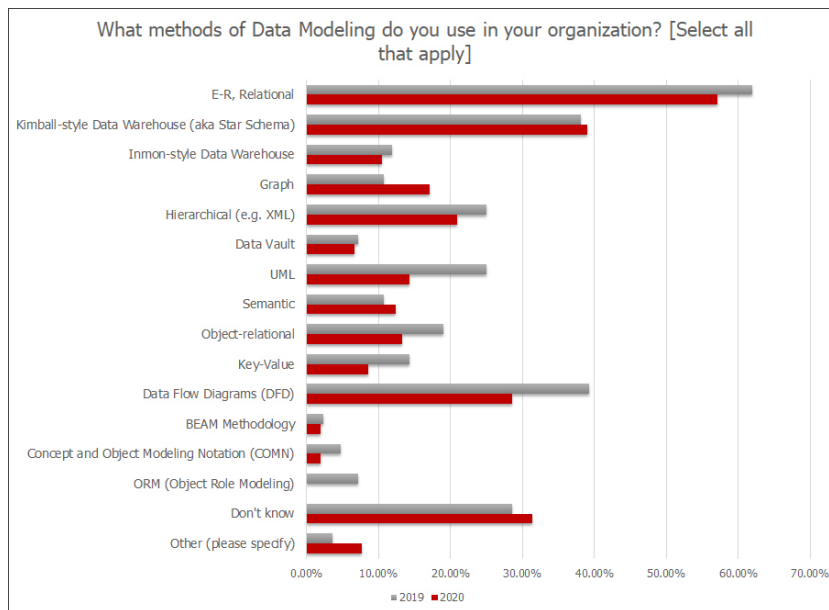
• Don't know: 31.43%

Most respondents use Data Modeling for business insights, given their top choices. Data modelers use E-R/Relational and Kimball-style Data Warehouse (aka Star Schema) to plan relational and data warehouse systems, platforms best serving Business Intelligence (BI).

This result continues with a noticeable trend in 2020. As our previous analysis demonstrated, 71.76% have implemented Business Intelligence and Reporting and 69.41% have implemented a data warehouse. The top Data Management goal and driver response, as indicated by Figure 8, was "gaining insights through reporting and analytics." We found it in line that preferred Data Modeling would align with such Data Management goals.

Also, notable, graph databases have more usage. Results in 2019 showed 10.71% used graph databases. This percentage increased 6.43% in 2020 to 17.14%. This result also likely points to the continued interest in reporting and business insights as organizations look to methods such as an enterprise knowledge graph to understand their data assets in a holistic way.

C. Types of Models and Diagrams

The next question sought to understand what types of models and diagrams are in active use. [Figure 19]:

► **"What types of models and diagrams do you use in your Data/Enterprise Architecture? [Select all that apply]"**
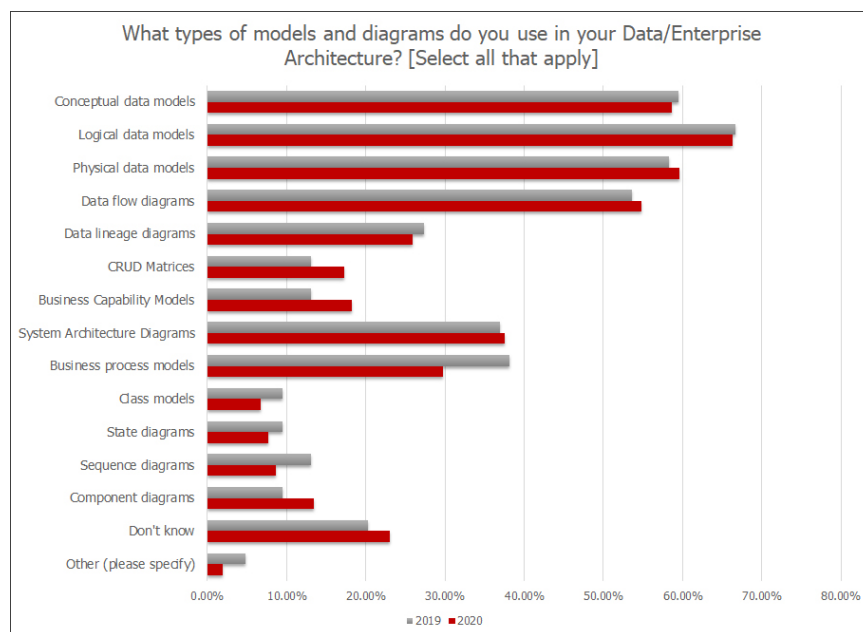

Figure 19: Data Models and Diagrams

Respondents prefer most (with a small spread in model choice):

- Logical data models: 66.35%

- Physical data models: 59.62%

- Conceptual data models: 58.65%

Top models and diagrams chosen in 2020 (logical, physical, and conceptual) align with a strong focus on business insights and analysis. Also, 2020 results align with those from 2019, when participants chose logical (66.67%), physical (58.33%), and conceptual (59.52%) data models as the top three.

That the logical data model represents the most popular choice in 2019 and 2020 makes sense. This model type captures and integrates business rules used across the organization in a straightforward visual way. Business and IT can then organize their discussions around the logical model, making more progress towards a viable data solution.

In 2020, respondents did show a slightly stronger preference for physical than for conceptual data models. In 2020, 59.62% chose physical models 1.29% more than 2019 at 58.33%. We did not think the increase as significant, as both physical and conceptual models underlie successful Data Architecture.

D. Concluding Comments

Two insights came from additional comments on Data Modeling. First, data models remain a "tried and true" tool for data-centric organizations. One participant observed:

- "Data Modeling has remained core to our organization for the past fifteen years. We continue to model data for both our online analytical processing (OLAP) and online transactional processing (OLTP) systems."

Second, the cost of Data Modeling tools remains a concern. This observation falls in line with the results seen in Figure 9 about the software tool impact. We saw high-cost concerns mirrored in that section. A respondent noted:

- "Good tools are expensive and cannot be made available to as many people as we would like."

"

Data Modeling has remained core to our organization for the past fifteen years. We continue to model data for both our online analytical processing (OLAP) and online transactional processing (OLTP) systems."

"

9. BIG DATA ECOSYSTEM TECHNOLOGIES

Big Data refers to large data sets of varying types — structured, unstructured, and semi-structured — that can be collected, stored, and analyzed to provide insights for organizations. We wanted to know Big Data's impact on Data Management, and asked three questions to get more information.

A. State of Big Data Management

First, we wanted to know if people were using Big Data ecosystem technologies. We asked [Figure 20]:

▶ **"Are you currently using a Big Data platform?"**
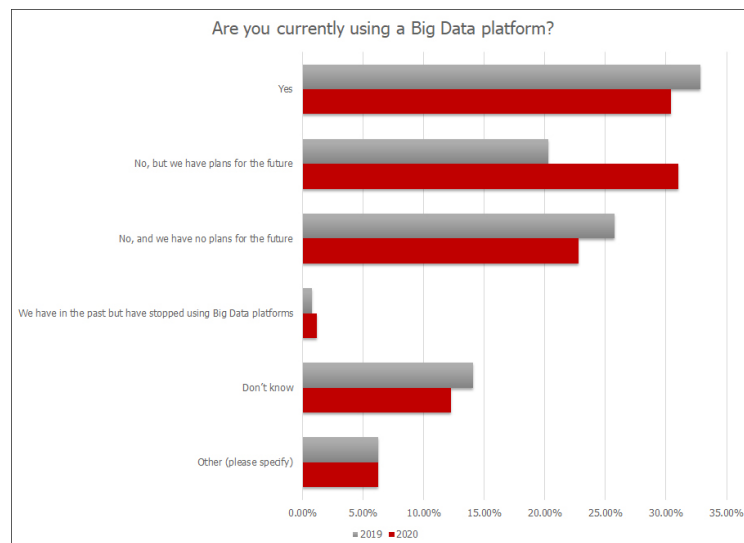
Figure 20: Big Data Platforms

Percentage breakdowns were as follows:

* No, but we have plans for the future: 30.99%

* Yes, we have a Big Data platform: 30.41%

* No, and we have no plans for the future: 22.81%

* Don't know: 12.28%

Big Data platforms continue to generate interest among survey participants. 61.4% of organizations have a Big Data platform in place or are planning to implement one in the future. Respondents interested in future Big Data use increased 10.68% from 2019 (20.31%) to (30.99%) in 2020.

However, previous results show that organizations [Figures 6 and 7] have no urgency in moving to a Big Data platform. Instead, organizations put other priorities first, like a solid foundation for Data Governance. Also, it could be that firms are taking a wait-and-see approach until Big Data platforms demonstrate more concrete benefits.

B. Big Data Use Cases

To gain more clarity into why organizations were using Big Data technologies, we asked the following of those who answered "yes" to having a Big Data platform. [Figure 21]:

▶ **"For what use cases are you using Big Data? [Select all that apply]"**
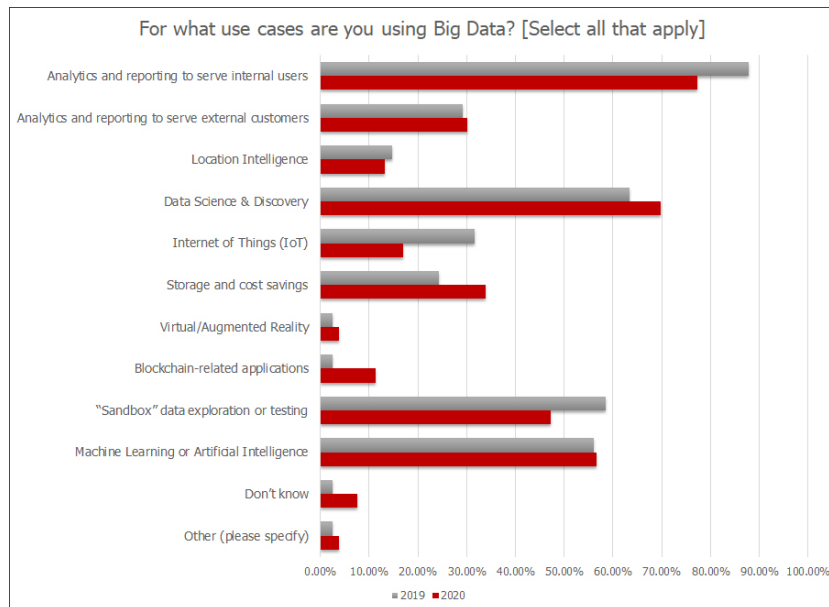
Figure 21: Big Use Cases

The top Big Data use cases include:

- Analytics and reporting to serve internal users: 77.36%

- Data Science and Discovery: 69.81%

- Machine Learning and/or Artificial Intelligence: 56.60%

Results reflected a trend toward data-driven insights, consistent with the report's other findings. Analytics and reporting to serve internal users, Data Science & Discovery, and Machine Learning and/or Artificial Intelligence use cases scored solidly in 2020 and 2019 (87.80%, 63.41%, and 56.10% respectively).

However, disillusionment in getting business information readily from Big Data manifests in 2020 results. While Data Science use cases increased by 6.40% between 2019 and 2020, Analytics and Reporting decreased 10.44%. Respondents want a Big Data platform for Data Analytics as their top Big Data use case in both 2019 and 2020, but they are trying to figure out how to implement it. In the next question, we will see this drive reinforced for those implementing a data lake.

Outside of business insights, results generated less interest in other options. For example, the Internet of Things (IoT) took a back seat in 2020 (16.98%) as compared to 2019 (31.71%) — a drop of -14.73%. Of interest is the increase in blockchain implementations, which, while still low compared to other initiatives (at 11.32%), saw an 8.88% increase over 2019 (2.44%).

C. Data Lakes

A Big Data platform typically uses data lake, an environment ingesting vast amounts and types of data, to function correctly. We asked of those using a Big Data platform [Figure 22]:

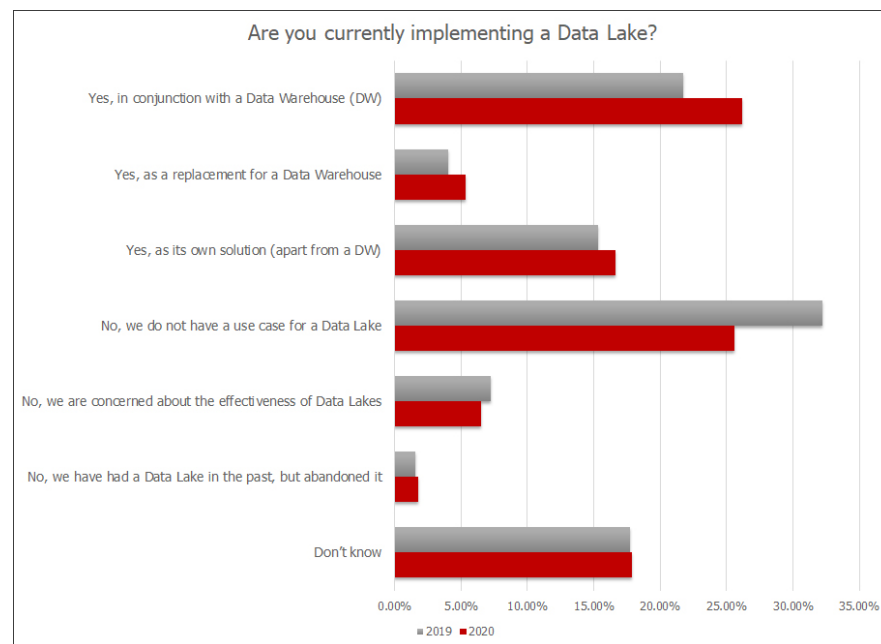▶ **"Are you currently implementing a Data Lake?"**

Figure 22: Data Lake Implementation

Top responses in 2020 were as follows:

- Yes, in conjunction with a data warehouse (DW): 26.19%

- No, we do not have a use case for a data lake: 25.60%

- Don't know: 17.86%

- Yes, as its own solution (apart from a DW): 16.67%

The largest use case for data lakes is in conjunction with a data warehouse, which aligns with organizations' needs for robust analytics and reporting. Using a data lake with a data warehouse saw a 4.42% rise between 2019 (21.77%) and 2020 (26.19%). Many respondents in both 2020 (25.60%) and 2019 (32.26%) said they do not have a use case for a data lake.

D. Concluding Comments

Respondents added that they had a bit of disenchantment with Big Data and data lakes. Notable comments included:

- "Our Big Data platforms are data swamps."

- "I think we had a Big Data platform or a data lake, but I am not clear as to what it has accomplished."

- "Big data and data lakes do not deliver on their early promises and can be costly."

Perhaps due to previous market hype and overinflated expectations, organizations do not see a current need for Big Data platforms. Maybe survey participants will consider Big Data systems after they have a stronger foundation for Data Governance, Data Architecture, and Data Strategy.

> "
> *Perhaps due to previous market hype and overinflated expectations, organizations do not see a current need for Big Data platforms. Maybe survey participants will consider Big Data systems after they have a stronger foundation for Data Governance, Data Architecture, and Data Strategy.*
> "

10. DATA PLATFORMS AND STORAGE

This study wanted to know what data platforms and storage those surveyed used in their organizations and asked six questions. The first set centered around data sources or platforms used now as well as plans for the next one to two years. Where companies applied cloud technologies [Figure 23], we asked two other questions about the reasons for and concerns about moving to the cloud. All participants answered a question about blockchain usage. We asked those who used blockchain where they used it. Finally, we asked an open-ended question for further comments on data platforms and storage.

A. Data Platforms

To gain a clearer understanding of platforms and storage application, we asked the following [Figure 23]:

▶ **"Which of the following data sources or platforms are you currently using? [Select all that apply]"**
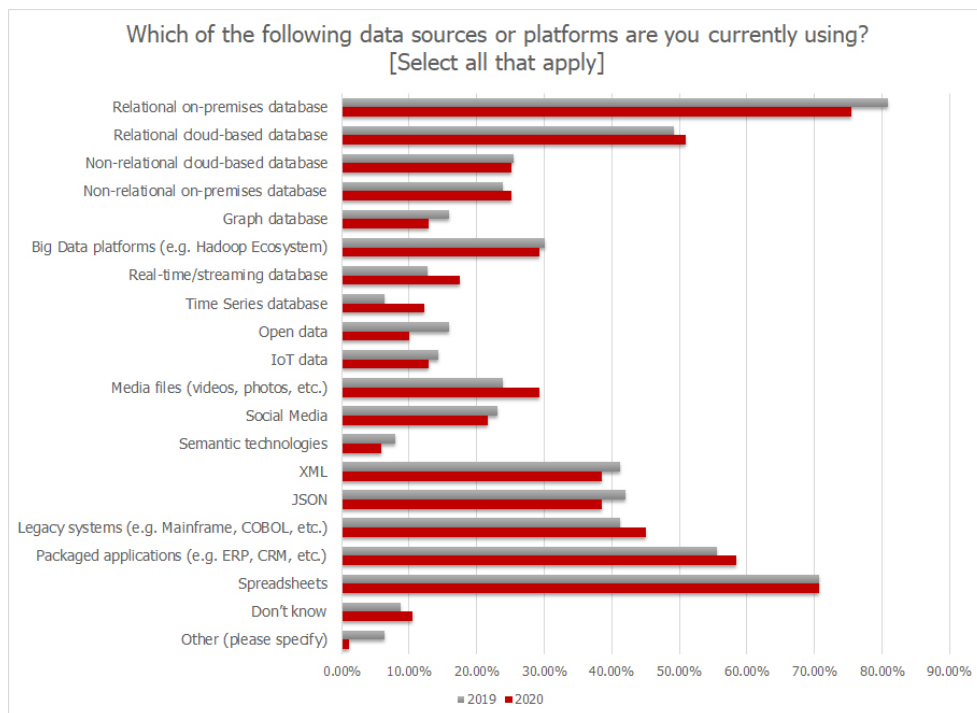

Figure 23:Data Sources or Platforms

Top data sources or platforms for 2020 were as follows:

- Relational on-premise database (e.g., Microsoft Access): 75.44%

- Spreadsheets: 70.76%

- Packaged applications (e.g., ERP, CRM, etc.): 58.48%

- Relational cloud-based database: 50.88%

The least used technologies included:

- Semantic technologies: 5.85%

- Open data: 9.94%

Results are consistent with 2019 in that relational databases, spreadsheets, and ERP/CRM systems led the technology stack in terms of usage. For relational databases, there has been a small shift away from on-premise databases (- 5.51%) toward cloud-based relational databases (1.67%) compared to 2019.

After relational databases, those surveyed predominately selected spreadsheets, and packaged applications (e.g., ERP, CRM, etc.). In 2020, 70.76% of those surveyed chose spreadsheets, similar to 2019 (70.63%). Packaged applications saw a 2.92% increase from 2019 (55.56%) to 2020 (58.48%). Reliance on spreadsheets and packaged applications remains high due to their familiarity and ease of use. However, high usage of spreadsheets may also indicate data silos and opportunities to collaborate better through Data Governance.

Although the relational database, spreadsheets, and packaged applications represented top choices, another notable increase occurred. The time-series database, a non-relational database system designed to store and retrieve data points and timestamps, saw an increase (5.93%). In 2020, 12.28% of those surveyed currently used time-series databases as compared to 2019 (6.35%).

The largest increase in usage was found in media files, time series databases, and real-time/steaming databases. In 2019, 23.81% of those surveyed responded that they use media files (video, photos, etc.). This value changed in 2020 to 29.24%, a 5.43% increase. Likewise, real-time data streaming databases saw more usage (4.84%). In 2019, 12.70%, used real-time/streaming databases compared to 17.54% in 2020.

> "
> *Reliance on spreadsheets and packaged applications remains high due to their familiarity and ease of use. However, high usage of spreadsheets may also indicate data silos and opportunities to collaborate better through Data Governance.*
> "

B. Future Plans for Data Platforms and Storage

We asked the following to find out future platform and storage plans [Figure 24]:

▶ **"Which of the following data platform/data storage technologies do you plan to use in the next 1-2 years? [Select all that apply]"**

Which of the following data platform/data storage technologies do you plan to use in the next 1-2 years? [Select all that apply]
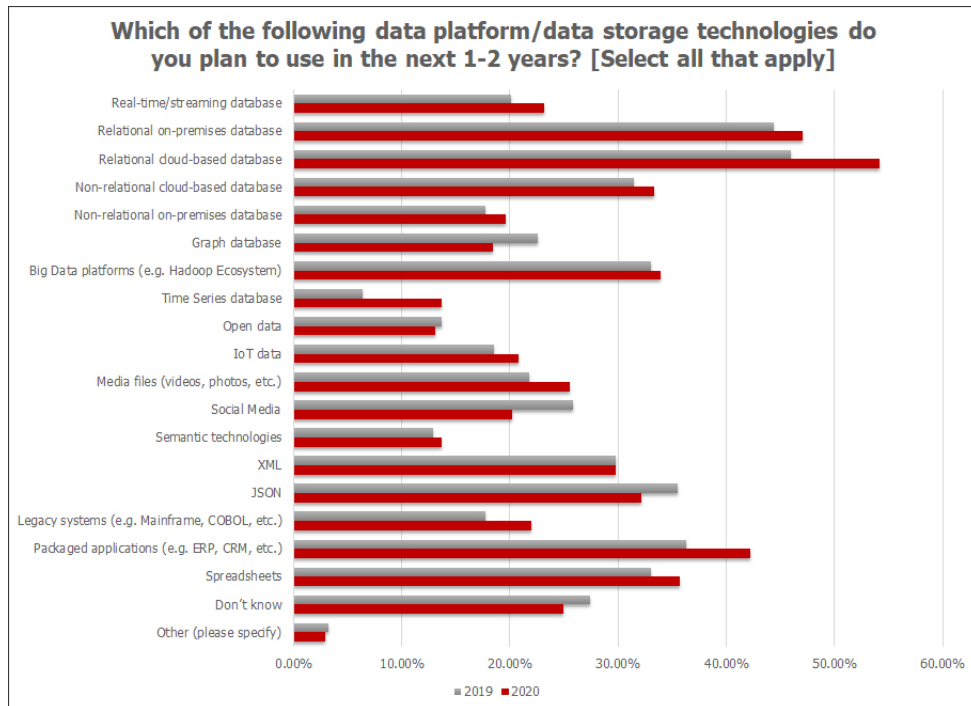
Figure 24: Data Sources or Platforms Plans in Next 1–2 Years

Survey participants planned on using tried and true systems:

• Relational cloud-based databases: 54.17%

• Relational on-premise databases: 47.02%

• Packaged applications (e.g., ERP, CRM, etc.): 42.26%

• Spreadsheets: 35.71%

The least popular platforms or storage selections included:

• Open Data: 13.10%

• Time series databases: 13.69%

• Semantic technologies: 13.69%

ROrganizations intend to continue with relational database platforms to drive business insights, and this trend is strengthening, albeit with a shift to cloud-based systems. In 2019, 44.35% anticipated using a relational on-premise database in the next year or two. This response increased 2.67% in 2020 to 47.02%.

Future relational database implementations will continue to increase into the cloud. Plans over the next year or two to implement a cloud-based relational database jumped 8.20% from 2019 (45.97%) to 2020 (54.17%).

As seen in Figure 23, time series databases have generated significant interest. In 2019, 6.45% indicated a one to two-year plan to implement a time-series database. This number rose 26.88% in 2020 to 33.33%, a rank of third in emerging platform use. This survey was the first to notice such a tendency, probably corresponding to a rise in the Internet of Things (IoT) use cases.

Surprisingly, the legacy system (e.g., mainframe, COBOL, etc.) implementations garnered new enthusiasm in 2020. In 2019, only 17.74% planned to use legacy systems. In 2020, 29.76% of respondents anticipated legacy system usage — up 12.02%. Legacy technology has proved a "tried and true" workhorse over the last decades, especially for government and financial institutions. A notable example was the call from the governor of New Jersey in the U.S. for COBOL programmers to help with the unemployment systems seeing increased usage due to the COVID-19 unemployment crisis.

C. Cloud

As we see in Figure 25, the cloud dominates many survey participants' plans. Cloud computing provides computation, software, data access, and storage systems without requiring knowledge of the physical location and configuration. For those who use cloud-based databases, we posed a couple of questions. The first was [Figure 25]:

▶ **"What were your reasons for moving to the cloud? [Select all that apply]"**
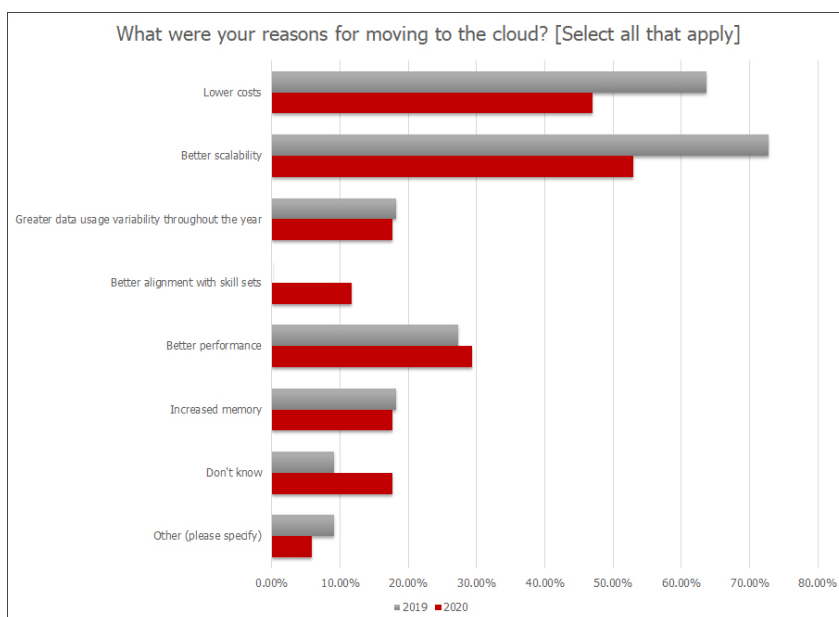

Figure 25: Reasons to Move to the Cloud

Those surveyed preferred the following reasons the most:

• Better scalability: 52.94%

• Lower costs: 47.06%

The preference "with better alignment of skillsets" ended up at 11.76%.

Elasticity and increased scalability with less cost only as needed has continued respondents' migration to the cloud. The 2019 survey also showed lower costs (63.64%) and better scalability (72.73%) as top drivers. This inclination will likely solidify in future investigations.

Respondents were then asked [Figure 26]:

► **"What are your concerns regarding moving data to the cloud? [Select all that apply]"**
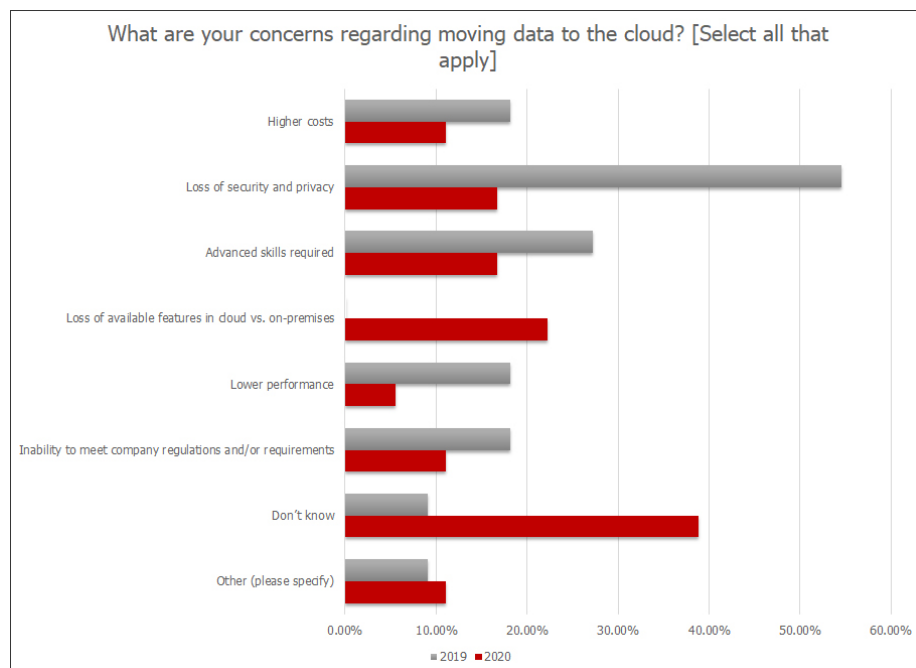

Figure 26: Concerns About Moving to the Cloud

When asked about concerns in moving to the cloud, survey selections broke down as follows:

• Don't know: 38.89%

• Loss of available features in cloud vs. on-premises: 22.22%

Survey results [Figure 25] showed confidence with professionals who have cloud-based capabilities. In 2020, 11.76% responded that moving to the cloud better aligned with skill sets whereas in 2019 0% selected that option. Also, when asked about concerns moving to the cloud [Figure 26], participants chose advanced skills required at -10.60% in 2020 (16.67%) compared to 2019 (27.27%). These results suggest more cloud skillsets among the workforce.

Survey participants felt more comfortable with cloud security and privacy than in previous surveys. Most notably, only 16.67% of participants in 2020 had anxiety around a loss of security and privacy in the cloud, while in 2019, 54.55% worried about cloud security and privacy. This concern had a drop (-37.88%) over the course of the year.

Some participants did have a general discomfort around the cloud but could not pinpoint the reasons for this worry. In 2020, 38.89% of those surveyed responded "don't know" to their concerns, an increase of 29.80% from 2019 (9.09%). However, general anxiety about the cloud has not slowed its adoption.

D. Blockchain

Blockchain, a combination of distributed databases and storage devices for this data, has promise for adding trust in an untrusted environment. We were curious as to its use and impact in Data Management. The survey asked [Figure 27]:

▶ **"Is your organization currently using blockchain technologies?"**
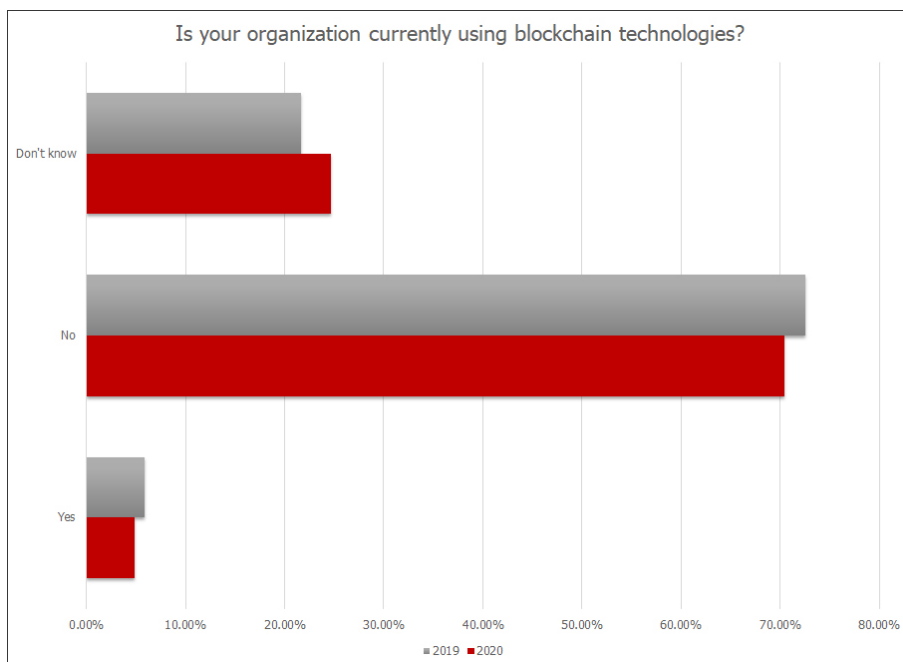

Figure 27: Blockchain Use

Responses were:

• No: 70.48%

• Don't Know: 24.70%

• Yes: 4.82%

Only a small percentage of organizations are currently using blockchain (4.82%) with a slight decrease from 2019 (-1.01%). While blockchain usage was listed as a driver for data lake implementation, it does not represent a significant usage driver among respondents.

For those who said they used blockchain, we wanted to know how they applied the technology. The following question was posed. [Figure 28]:

▶ **"For which use cases are you using or considering use of blockchain technology? [Select all that apply]"**
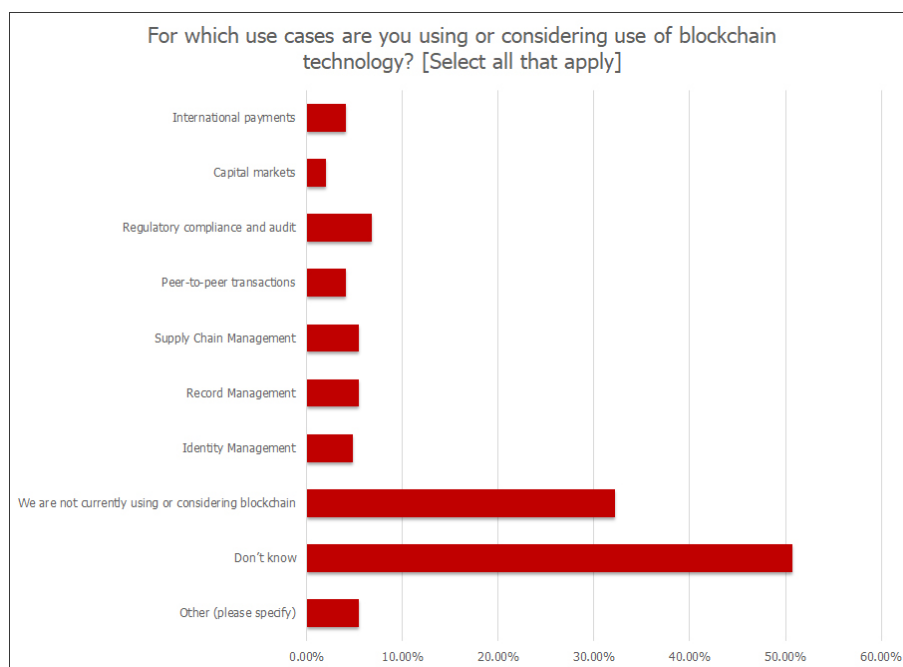

Figure 28: Specific Blockchain Use Cases

The results shown here did not amount to anything substantial. Most people did not know about blockchain use cases, 50.68%. The next most selected answer, "we are not currently using or considering blockchain," made up 32.19% of responses. Participants further indicated that they do not use blockchain.

E. Concluding Comments

Additional comments noted difficulties with blockchain platforms. Comments included:

- "We do not use blockchain as it is a write-once, distributed, read-only relational data store. We don't need a new solution to a problem that doesn't exist. Blockchain is nothing more than a NoSQL database, where the nodes can be consumed and validated independently."

- "Blockchain is overhyped — a technology looking for a solution outside cryptocurrencies — and will be at increasing risk as quantum computing capabilities and usage grow."

11. NEW TECHNOLOGIES AND TRENDS

The drive to digitally transform for better business efficiency and effectiveness requires integrating a variety of data-centric technologies with all aspects of a business. In the last decade, innovations in data capabilities have leaped forward. This section looks at these newer technology trends and their adoption, including:

- Internet of Things (IoT)

- Data Virtualization

- Containerization and Kubernetes

- Serverless Computing practices such as PaaS and FaaS

- Data Automation advances

- AI, Machine Learning, and Deep Learning

- Industry 4.0

- Digital Twins, which provide the virtualization of physical products or assets

A. New Technologies

We asked participants:

▶ **"Which of the following is your organization currently leveraging? [Select all that apply]"**

A significant percentage (40.98%) said they don't know what new technologies their organization is implementing [Figure 29]:
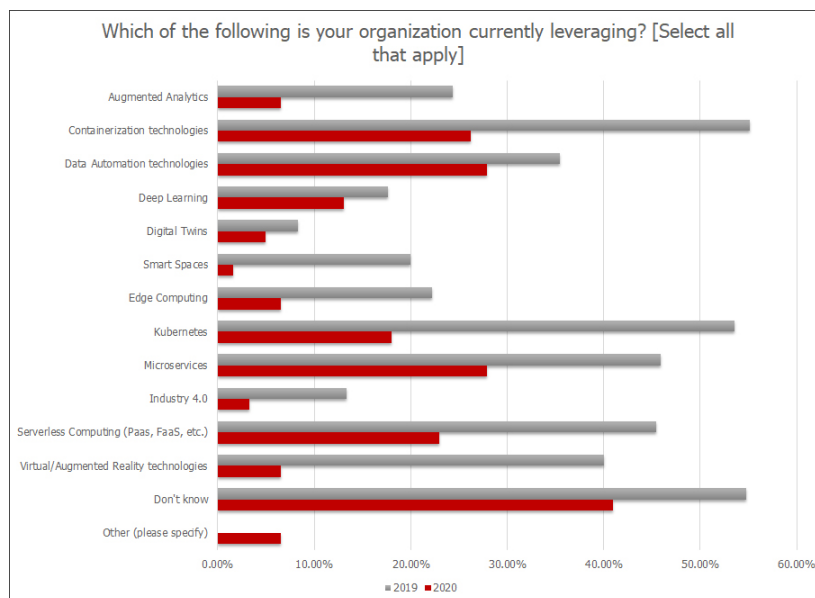

Figure 29: New Technologies Leveraged

Of those that did know which technologies their organizations leveraged, respondents mentioned the following as the top three:

- Data Automation Technologies: 27.87%

- Microservices: 27.87%

- Containerization Technologies: 26.23%

Businesses have the following as the lowest priority:

- Smart Spaces: 1.64%

- Industry 4.0: 3.28%

- Digital Twins: 4.92%

An uncertain and unstable marketplace has encouraged organizations to be very conservative about their investments in new technologies. While 2020 respondents picked Data Automation Technologies (27.87%), Microservices (27.87%), and Containerization Technologies (26.23%) as most used, these overall percentages declined markedly (-7.55%, -18.08%, and -28.94%) from 2019 (35.42%, 45.95%, and 55.17%).

Kubernetes, Virtual/Augmented Reality Technologies, and Containerization Technologies represented the largest decrease in current use. Kubernetes applications fell from 53.57% in 2019 to 18.03% in 2020 (- 35.54%). Virtual/Augmented Reality Technologies diminished (-33.44%) from 40.00% in 2019 to 6.56% in 2020. Also, Containerization Technologies dropped (-28.94%) from 2019's 55.17% to 26.23% in 2020.

> "
> *An uncertain and unstable marketplace has encouraged organizations to be very conservative about their investments in new technologies.*
> "

We followed up with the following question: [Figure 30]:

▶ **"Which of the following is your organization planning to implement within 1-2 years? [Select all that apply]"**
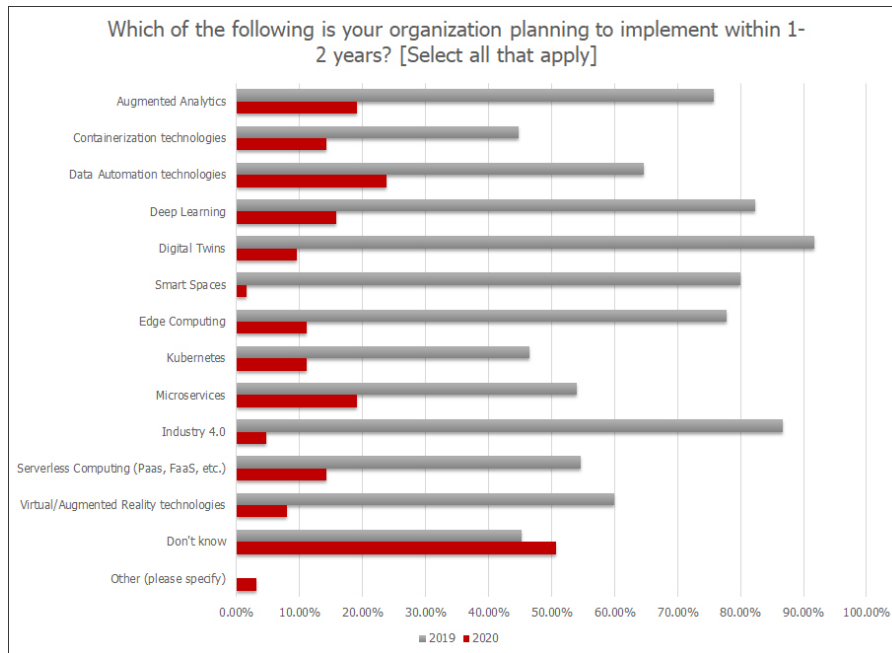

Figure 30: New Technologies Planned to Implement

Looking at what respondents said their organizations would implement within one to two years, results also showed declines in technology implementation.

A significant percentage (50.79%) did not know what technologies their organization would plan to implement in the next few years. Those participants who knew answered conservatively.

- Data Automation Technologies: 23.81%

- Augmented Analytics: 19.05%

- Microservices: 19.05%

Results looking toward the implementation of new and emerging technologies in the next one to two years mirror those from the previous question, a shift from carrying out new data technologies and techniques and toward establishing a firm Data Management foundation.

In 2020, 50.79% did not know what new technologies and trends their organizations planned to implement as compared to 45.28% in 2019 — a 5.51% increase. With the uncertainty in the market due to the COVID-19 pandemic, 50.79% percent said that they did not know what trends would be implemented in the future. Notably, all areas saw a significant decrease, with not a single area showing an increase in future usage. Areas with the sharpest decline

Real-time Analytics driven by AI, Machine Learning, and Metadata Management will have a profound impact on Data Management.

include: Digital Twins (-82.15%), Industry 4.0 (-81.91%), and Smart Spaces (-78.41%). These declines are likely due to slowdown in the manufacturing sector due to the reduction in consumer demand relating to the COVID-19 lockdown regulations.

B. Future Trends

The survey asked respondents the following open-ended question to finish out the study:

▶ **"What do you see as the next top three emerging trends in Data Management that will cause the most profound changes in the industry?"**

Survey participants chose Artificial Intelligence (AI), Machine Learning (ML) combined with Metadata Management, Cloud Computing, and associated data catalogs. Notable quotes included:

- "AI will have a huge impact on Data Management, especially in facilitating the automation of Data Management, and predicting future events such as engine failure, flooding, and landslides."

- "Great changes will come in supporting intelligent Business Process Automation, through active Metadata Management, AI, and Machine Learning."

- "Real-time Analytics driven by AI, Machine Learning, and Metadata Management will have a profound impact on Data Management."

Responses re-emphasized the need for a holistic, analytical view of the business landscape. This vision covers coordinated enterprise-wide Data Management so that organizations can genuinely be data-driven and foster digital transformation. Solid Metadata Management will be essential to achieve this goal, and firms have a greater appreciation of this need [Figure 12].

C. Concluding Comments

The following respondent's insight, which lines up with this survey's findings, stated:

- "Relational database systems will remain a foundation technology for most Data Management because of its unique mathematical model and universal application. Drawbacks to relational database technologies are not as great as most NoSQL vendors say."

12. CONCLUSION

Today's digital economy provides significant opportunities as well as challenges for Data Management. More organizations want to transform digitally, build on their data assets, obtain valuable insights, and grow and protect their business. In early 2020, COVID-19 shut down much of the world's economy, putting digitization at the forefront, from a nice-to-have to a must-have. As a result, organizations require a strong data foundation to support their digital transformation and analytic needs.

Fortunately, many organizations have recognized an increased need for collaboration and Data Governance to succeed in the digital economy. In 2019, organizations started or already had Data Governance in place. Now, in 2020, commitment to firm data foundations has increased and business investment in enterprise-wide Data Governance has accelerated.

Business executives are putting more energy into guiding Data Management. Those in the C-level position have more influence in developing the organization's Data Management and in creating and implementing a Data Strategy. In 2020, Data Architecture has increased significantly, along with Metadata Management, in order to better understand the organization's data assets. Today's businesses are taking time to create a strong Data Management foundation supporting a robust data-driven culture.

Future plans require a delicate balancing act in order to sustain and advance Data Management foundations while keeping abreast of emerging technologies and trends, such as AI and Machine Learning, to gain competitive advantage. Many organizations are turning to a back-to-basics approach, focusing on the fundamentals of reporting and analytics, Data Governance, and Data Architecture.   A strong Data Strategy that balances new technology with core fundamentals to align with market trends will be critical for future success. Many who have developed a solid Data Management foundation in 2020 will adapt quickly to future market shifts in the volatile years ahead.

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