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DATA STRATEGY & MANAGEMENT IN FINANCIAL MARKETS

A WHITE PAPER TO THE INDUSTRY

DTCC
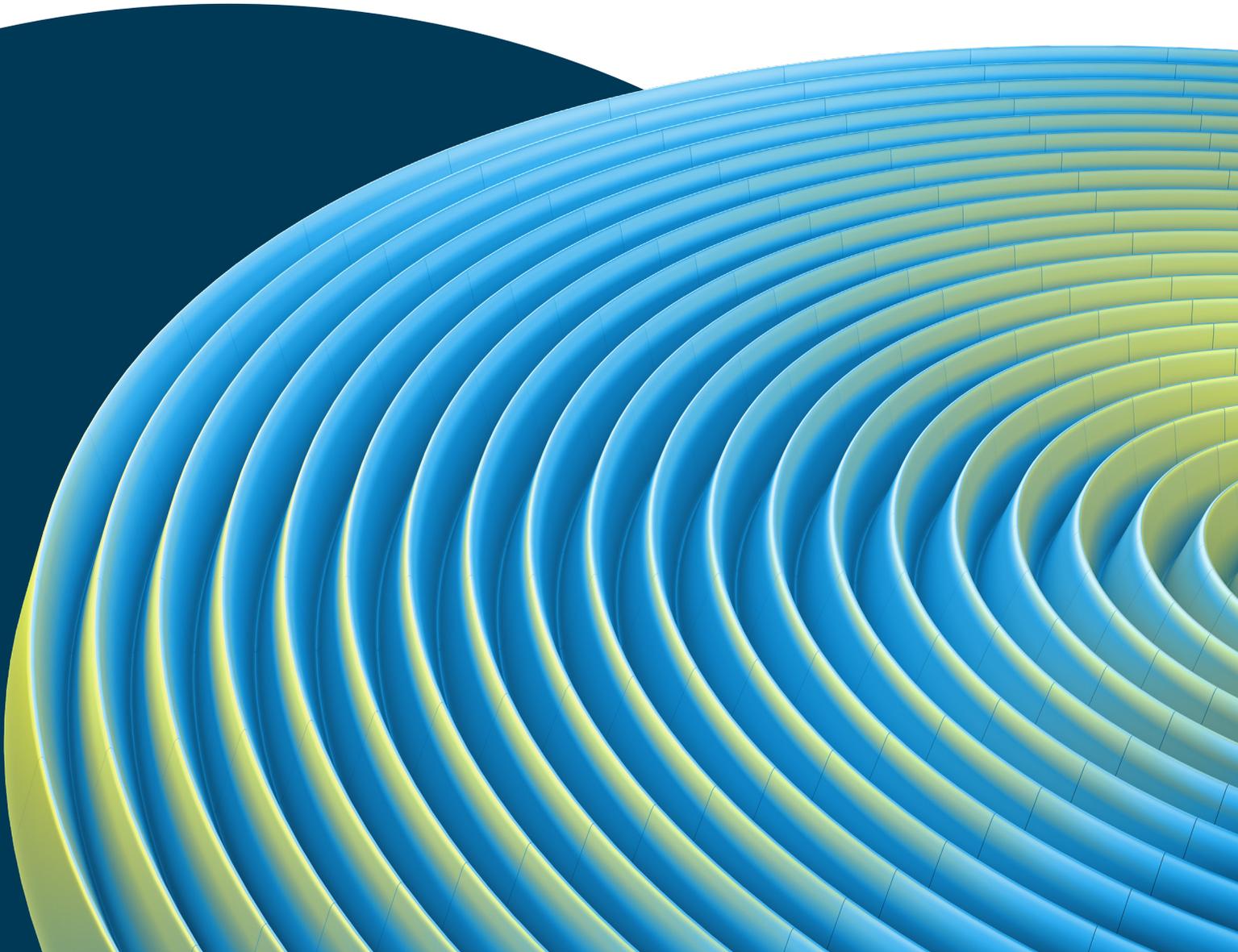
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EXECUTIVE SUMMARY

Financial markets have long been all about data. Investors with better data – more complete, timelier, in more digestible and actionable form – have an advantage over those that are less well-informed. Data helps decision makers pursue alpha, provide insights or manage risk. It is essential to negotiating and confirming the terms of proposed trades, to executing transactions, and to settling transactions. Indeed, a huge part of trading strategies, risk management, compliance, and regulatory oversight depends on data about historical transactions and client activities.

In the past, progress has been steady and linear. However, recent acceleration in adoption of modern technologies, especially cloud, increased willingness to collaborate, and evolution of business demand, all have the potential to drive large-scale change for the industry. Data will remain vital – but how it's stored, organized, and exchanged is changing rapidly. In this white paper we examine pain points related to data exchange (i.e., how organizations make data available to one another) and data management (i.e., how an organization handles data), look at how key technologies can address these in the future, and consider hypotheses for the future. We also discuss what data providers and data consumers should focus on to maximize benefits. Data that is trapped or underutilized today will be configurable to offer new insights, faster. And, depending on the institution using the modern technologies, they may even support entirely new markets that are emerging in areas like climate change and environmental protection, digital assets and others.

DTCC has distilled its thinking about the future for data exchange and data management into four hypotheses on trends that we believe will drive the next decade of change in how data is used in financial markets.

- **Data will be more accessible.** Data users will have unprecedented flexibility in choosing what data to receive and how they receive it, breaking free from the constraints of exchanging fixed sets of fields at pre-defined time intervals. To enable this, data governance, privacy, and security will need to take center stage.

- **Interconnected data ecosystems will create a new infrastructure layer for the financial industry.** Industry participants will successfully free their own data from legacy systems and will not only master pooling it into their own data ecosystems, but, where useful and scalable, will connect them with others'. This will reduce duplication of data across the industry and will allow for co-development of innovative data insights. Data will be harvested along the entire trade lifecycle to drive insights such as post trade data enabling price discovery and trade execution strategies.

- **Capacity will be freed up to focus on data insights.** More efficient data management, rationalized data related technology stacks including Cloud computing, and automation of routine data tasks, will free up capacity, reduce the need for specialized data analysts and data operations teams, to focus on deriving data insights from the vast stores of data. Creating data products and insights will get simpler, not harder, with the right tools in place that will require less specialized resources. Technology will continue to diminish the marginal cost of developing new ideas for data analytics impacting business economics and ROI calculus in a significant way.

- **Data standards will become more "open source."** Specifically, we expect that the industry will continue to adopt more standard data models, i.e., ways to understand and describe data sets. The most viable use cases will be in reference data and transaction reporting. The benefit for the industry would be less redundancy and better quality in data across the financial industry.

We'll explore what each of these four hypotheses mean over the next pages – and sketch out what financial institutions will need to do to meet these goals.

Some predictions about the impact are fairly easy: These changes will allow different forms of operating model within and between organizations, lower cost, and reduce or eliminate organizational headaches like reconciling duplicative data stores or requiring substantial manual intervention to source data and verify data quality. Others, such as the new products and strategies that may flow from this technical innovation, are harder to predict, specifically as they relate to the application of shared data ecosystems, cloud platforms, artificial intelligence, and Distributed Ledger Technology (DLT).

Our modernization journey has been tightly coupled with our data strategy, positioning us to capture the full potential of recent trends and to enable more efficient data management and data exchange, with the level of resilience the industry requires of us. We offer some of our core thinking about the future to prompt a broader industry discussion and we welcome the opportunity to further develop the four hypotheses and to help us prioritize how we deploy our own data strategy through dialogue with our clients, partners, and regulators.

WHAT ARE THE PROBLEMS WITH DATA MANAGEMENT TODAY?

As financial markets grew more electronic, data moved center stage, and the industry developed a broad range of methods and formats for data exchange.

To date, the industry has been focused on standardization of data exchange across organizations, but little on standardization of how data is managed within an organization, including data models, data formats and data taxonomy used internally. Over time, this has created significant problems. Due to heterogeneous formats and disparate systems, most financial institutions use only a minority of the data they possess on a modern data platform to generate insight – the rest is simply used for processing activities. Meanwhile, several aspects of post-trade processes stubbornly remain manual, which means potentially valuable data never gets analyzed or even stored in modern technology platform. These inefficiencies in data management cause operational risk at various points in the trade lifecycle, increase processing time and often require costly reconciliations.

To address a few of these issues, the industry put in place expensive asset class specific data exchange solutions that enable more straight through processing. However, these are often inflexible, unique to each firm and are often specific for individual asset classes – efficient for the given purpose, but inflexible for automated transaction processing.

Based on our analysis and discussions with our clients and partners, DTCC believes that today's data infrastructure is inefficient for four primary reasons.

1. DATA EXCHANGE IS DICTATED BY OVERLAPPING STANDARDS AND FORMATS, REQUIRING A HIGH DEGREE OF MAINTENANCE

Data exchange standards typically assume point-to-point communication with asset class specific and inflexible formats, as well as bespoke data models. This has the unfortunate consequence of limiting the ability to explore the interlinkages of data. Meanwhile, upgrades, including expansion or harmonization of data fields, require lengthy consultation processes, industry consensus, and costly implementations for those adopting the new standard. While current technology does allow for data to be "translated" from one data exchange format to another, this process is typically far from being fully automated or streamlined. The future is in more flexible data sharing. The paradigm is based on letting data producers send data to many users or let users retrieve data at their convenience in a standard format. This flexibility will let users create simpler workflows and lower technology spend that will foster advanced analytics and innovation.

2. THE WAY DATA IS STORED IN MOST CURRENT ORGANIZATIONS PREVENTS USERS FROM EXPLOITING IT FULLY

Information in the form of metadata (i.e., descriptive data that captures attributes of the underlying data) is often missing or embedded in specific data stores of applications, which significantly limits how broadly the data can be used and re-used in new ways. The emerging best practice is to store data, including metadata, separately, in dedicated locations, akin to a virtual library, so it can be accessed by many applications for many purposes. In addition, "data tagging or cataloging" can be applied to provide additional context to data items (e.g., privacy attributes). This would let users within an organization innovate without having to search to find data the organization already possesses. Additionally, these enhanced data tags can also be utilized to allow external parties to discover the properties of proprietary data sets without the need to "see" the actual data.

3. TODAY'S DATA INFRASTRUCTURE CONTRIBUTES TO SIGNIFICANT NON-FINANCIAL RISK AT FINANCIAL INSTITUTIONS

Inefficiencies in the way data is exchanged and stored mentioned above have all contributed to IT and operational complexity, with substantial implication for operational risks (and costs). Regulators are requiring organizations to get a strong grasp on their data, as well as ensure privacy, security, and resilience of their systems. This has so far taken the form of regulatory focus on data lineage especially when that data is used in specific regulatory filings. Data privacy and heightened KYC and AML requirements are forcing firms to trace and verify customer data across all their systems to ensure compliance. We expect regulators' focus on data management and resiliency to continue to increase. Examples (at different stages of implementation) include, Europe's Central Securities Depository Regulation (CSDR), General Data Protection Regulation (EU), FINRA's Consolidated Audit Trail standards in the U.S. and data quality of transaction reporting across global regulatory jurisdictions. The industry has been typically addressing each of these requirements in regulation specific implementation programs which has only increased operating cost.

4. MANY DATA SETS THAT FINANCIAL INSTITUTIONS RELY UPON ARE NOT OF DESIRED DATA QUALITY TO SUPPORT DECISION MAKING, LET ALONE AUTOMATED DECISION MAKING

For all the reasons outlined above, data quality is often difficult to ascertain – more so in the case of commercial data, which, to date, has not undergone as much scrutiny as risk and regulatory data. At worst, incomplete or unvalidated data sets at times are used to support business decision making. At best, an organization can expect lengthy and costly analytics development lifecycles, that often result in standard aggregated reports – not dynamic and predictive analytics tools. As we have seen, what began as a fragmented approach for global trade reporting is now evolving to a more harmonized approach but even that might not get us to complete alignment. For financial institutions to become faster moving and more agile, they will need the ability to perform larger volume and more flexible ad-hoc analyses, at lower cost. Additionally, new products and resilience can be developed by sharing information across firms – e.g., to develop more robust risk analyses and models. This need has in the past often been addressed by data brokers and vendors, who for a large premium turn consumers' own information into usable analytics.

Most of these data challenges are not new or unrecognized. However, we believe that recent developments, including cloud infrastructure, increased focus on using APIs and data management applications, have created conditions that allow for disruption of the status quo, heralding in of a new potential paradigm for data management and data exchange.

THE ENABLING FOUNDATIONS FOR CHANGE

Based on our research, three factors are driving change in how data is exchanged and managed. Broadly, these are: 1) Acceleration in adoption of new technologies. 2) Cultural shift towards more collaborative approaches. And 3) Growing financial innovation, requiring modern approaches to data.

1 — ACCELERATION IN ADOPTION OF NEW TECHNOLOGIES

Cloud computing

Financial institutions are re-architecting the way they manage data when modernizing their IT stacks and moving to cloud

- Opportunity to innovate around how data is shared and collaborated on

Advanced tech capabilities

Use of AI, ML, and big data is growing in financial services

- Expect many challenges preventing broader use today to be overcome

Digital assets and DLT

Regardless of how widespread adoption of DLT will be, institutions will need to adapt how they manage data to DLT to holistically bring data together across traditional and DLT-enabled markets

2 — CULTURAL SHIFT TOWARDS MORE COLLABORATIVE APPROACHES

Collaborate on data

With the adoption of new technologies, we expect greater cooperation across financial institutions when it comes to sharing and working with data

- Organizations will need to develop openness and flexibility

- Collaboration will need to be supported by strong governance around data, as well as high standards around privacy and security

3 — GROWING FINANCIAL INNOVATION, REQUIRING MODERN DATA APPROACHES

Boundaries of what can be traded

Modern ways to manage data are necessary enablers for growth of new asset classes and systematically incorporate ESG goals

- Data to measure progress against ESG goals is unique and currently opaque in quality, giving rise to need for new data related solutions

- The proliferation of digital assets may expand, specifically as tokens (stable coins or CBDC) drive adoption of asset for asset exchange structures; this will append data exchange

- Beyond digital assets, many new types of tradeable instruments are likely to crop up, that will not fit the mold of traditional financial instruments

THE FIRST CHANGE IS ACCELERATION IN THE ADOPTION OF NEW TECHNOLOGIES

Technology is evolving and being adopted in ways that both enable and necessitate change in data management and exchange. Notable examples include:

Cloud computing: The shift to cloud within financial markets is accelerating. As we explored in a securities industry technology study, majority of financial institutions (2/3) are expected to have applications that are fully cloud native or have fully adopted cloud by 2024[1].

As companies are moving their applications into the cloud, they often need to re-architect the way they handle and manage data, as well as fully document their data fields and data processes. Additionally, co-locating and linking applications in the cloud has become easier, resulting in early experimentations of firms in developing shared data ecosystems, be that through

- Development and shared use of "golden source" reference data – e.g., DTCC's Alert SSI (Standing Settlement Instructions) data solution

- Tracing and tracking of reference/derived data across firms to reduce cost of data purchases and data vendors (e.g., asset servicing information)

- Use of encryption and anonymization techniques to share information and develop more robust analytic sets without the need to involve data brokers

Finally, the rapid implementation of cloud-based tools is also making it much easier to derive new insights and to roll out new business processes faster, creating nimbler and more competitive enterprises.

Advanced Capabilities Such as Artificial Intelligence (AI), Machine Learning and Big Data: This set of technologies is already being used in algorithmic trading and several other discrete applications across financial markets, but their full potential is far from being realized. Early experiments with AI have revealed that most organizations lack the large-scale clean data sets to take advantage of AI at scale. There are many reasons for this, including the low quality of broad data sets beyond the narrow application purpose and the challenges of linking these disparate data sets. We believe that over the coming decade, institutions will continue to chip away at these problems by improving the structure and quality of input data, by improving tools and techniques to work with these advanced technologies, and through continued experimentation to find the most scalable use cases.

Digital Assets and Distributed Ledger Technology: Although use of DLT technology is relatively nascent, especially outside of digital asset marketplaces, it is uniquely positioned to transform the way data is exchanged and managed across all financial markets. The two core innovations of DLT, relevant for data management, are (1) distributed storage of information using a consistent and homogeneous data model, that exists outside of any individual firm's data environment; (2) automated and immutable validation of the accuracy and legitimacy of new entries on the ledger, without the need for reconciliation and audit trails.

We do not propose to make a prediction about how broadly DLT technology will be adopted, including whether it could replace all existing capital markets infrastructure. However, even in the more conservative forecast of DLT adoption, where the technology supports only digital asset markets, we expect transformative change for data exchange and data management. Specifically, institutions will need to find ways to bring together data from across traditional message / file formats based capital markets infrastructure and DLT based infrastructure that enables data sharing via nodes. Without a data strategy that harmonizes data across traditional and digital assets it will be impossible for financial institutions to continue to manage critical functions such as risk management, liquidity management, and client services.

THE SECOND BIG CHANGE IS A CULTURAL SHIFT TOWARDS COLLABORATION

We expect the technology changes described above to facilitate more cooperation with regards to data than ever before. We also expect to see more sharing of data – especially standardized reference information between partners and counterparties. We expect to see the emergence and growth of data utilities that serve many clients. Some organizations may even come to use partners' data stores as their own primary, or "golden," source of certain kinds of information. The specifics are emerging, but the theme is clear: More cooperation is the future.

The common thread among emerging ideas is the organizational need to develop the openness and flexibility needed to achieve the nimbleness and fast response times emerging technologies make possible. The task of assessing and valuing data sets and forging internal and external partnerships to implement new, more collaborative technologies and to create the new market mechanisms discussed below will necessarily fall on senior leaders, who must focus on developing the capabilities and cultural environment required for data exchange environments. For example, the capability to explore, discuss and analyze the potential for shared data under rigorous processes and procedures in a shared and collaborative environment today does not exist for many firms. Building them will require a deliberate effort of leaders to develop these through experimentation co-creative environments. Data standards such as ISO 20022 or ISDA's Common Domain Model are intended to enable collaboration and interoperability.

THE THIRD CHANGE WE SEE IS GROWING FINANCIAL INNOVATION, REQUIRING MODERN APPROACHES TO DATA

New markets and financial instruments are emerging all the time, and they often have different data needs than the ones that came before them. Flexibility in how data is managed and exchanged is needed to foster their development. A no exhaustive set of examples includes:

■ Trading of interests in private equity instruments is already expanding, often driven by investors' search for yield. The data environment is incredibly heterogeneous and bespoke – if liquidity and efficiency are to develop in these markets, a new approach is needed.

■ Focus on environmental sustainability, as well as other aspects of ESG, is giving rise to new classes of tradable assets, beginning with secondary markets for a variety of environmental credits. Down the road, it may be feasible to create even more new markets to serve such goals as clean water preservation or biodiversity promotion. However, concerted effort is required today to standardize and rationalize the data for these new asset classes.

■ Digital assets have begun trading in relatively known quantities like cryptocurrency and non-fungible tokens, but may expand from there, specifically as liability tokens (Stable coins or CBDC) drive adoption of asset for asset exchange structures. These again, will require definition of industry standard data models and data exchange methods.

Use of more modern ways to exchange and manage data is likely to considerably improve investors' and companies' ability to pursue the new asset classes and systematically incorporate environmental, social and corporate governance (or ESG) goals into their decision and control frameworks. Given the breadth of change required, competitive pressure from non-traditional firms and opportunity that is implied by these developments, successful firms will use a combination of the new technologies as well as collaborative approaches to derive competitive advantages.

These new forces offer exciting new opportunities for modernizing data exchange and data management across financial markets. Below, we envision how these factors will coalesce into a vision of the future.

OUR HYPOTHESES FOR THE FUTURE OF DATA EXCHANGE AND DATA MANAGEMENT

As a core service provider for post trade processing, DTCC has worked diligently to articulate its own vision of the future of data exchange and data management. We break it into four interlocking hypotheses for the future that will be explained in a moment.

First, it's good to underscore some of what acting on these hypotheses will require. The most important requirement – beyond the financial commitment involved in making technology related investments is to affect cultural change and enable a more collaborative environment.

The culture of the next generation of data exchange will be much more collaborative than the one it replaces. This is enabled by technology, however, it is driven by business necessity to exploit and connect data that has previously been generated but little analyzed. New paradigms will let participants transfer data to places elsewhere in the trading and data ecosystem where it can be put to new uses. Providers will collaborate more with their clients on jointly developing data sets and applications, and organizations will be able to break down internal silos.

Data models have been typically honed for point to point data exchange. They have not generally conformed to well-accepted standards but have been harvested within each institution for its own purposes or with the optimization of asset specific processes in mind. This has produced a large number of data models that are often incompatible - even within the same organization – and place a substantial burden on data users to interpret them and validate their accuracy. The goal is to move from technologies architected to serve company specific use cases, toward designs that bring together data in new ways, using more open architectures APIs.

The common element in ideas for next-generation solutions is an open environment that allows for selected and controlled access. We highlight the four vectors of this change in our graphic below:

FUTURE OF DATA EXCHANGE AND DATA MANAGEMENT

Accessible and Secure Data — A

B — Interconnected Data Ecosystems

Open-Source Data Standards — C

D — Focus on Insights
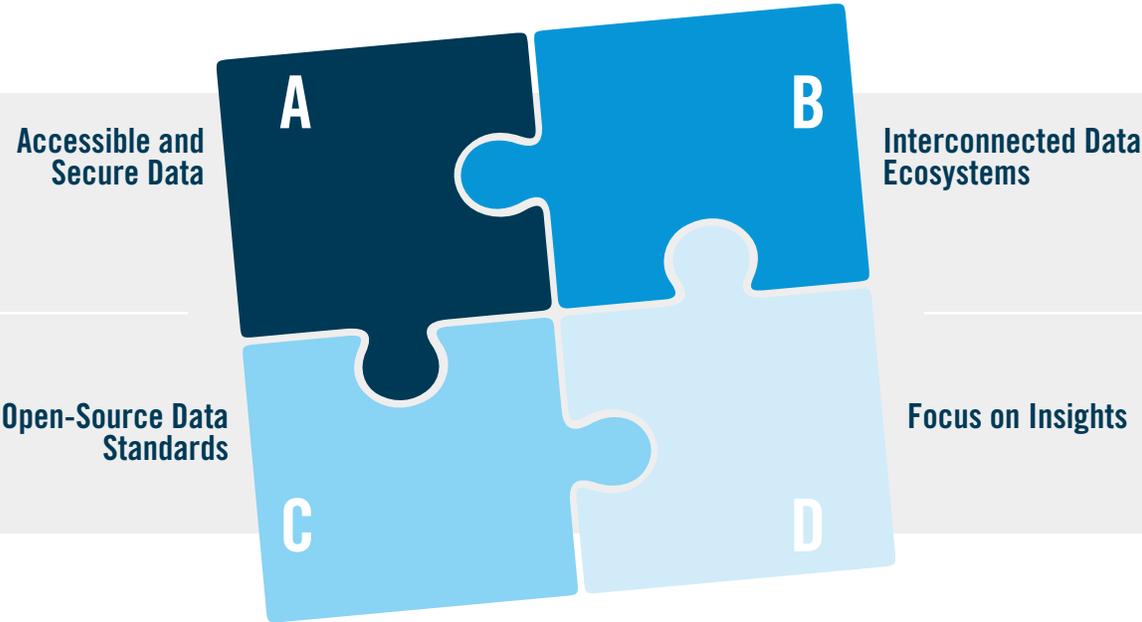
WHAT ACCESSIBLE AND SECURE DATA MEANS

More users will be able to get access to broader data, more easily, and put it to more uses faster. At a high level, this hypothesis suggests that participants will be able to consume more flexible services based on self-service oriented access to data, at greater granularity, enabled by seamless auto-translation of data formats and high-quality data catalogues to guide their search for relevant information. To enable this, data governance, privacy, and security will need to take center stage as well.

WHAT INTERCONNECTED DATA ECOSYSTEMS MEAN

Organizations will solve technical challenges that today prevent them from collecting data from multiple sources into a single data ecosystem. We also expect that participants will be able to selectively open their newly-unified data ecosystem to others, which will let them cooperate with partners or clients in developing new data use cases. Some may work so closely with partners or providers that they may choose not to adopt third-party data into their corporate networks, instead making their partners' data stores their own so-called "golden source" of data (e.g., for standard reference data sets). Use cases where connected data ecosystems would be most useful include security reference data, client reference data and historical pricing, where a common base of information is useful to many user organizations and where a commonly accepted authority

for establishing and maintaining the information can be put in place. To enable this, data privacy tools and solutions will need to evolve.

WHY OPEN SOURCE IS ESSENTIAL

In particular, open source data standards will take the pain out of routine tasks. There will be open-source libraries for application programming interfaces (APIs) and software development toolkits (or SDKs). Blockchain adoption will also require the use of common data standards and models.

HOW WILL EMPHASIS SHIFT TO INSIGHT

The greater volume of data available for use in creating strategies means the method of handling data will become fully or partially automated. This will make data operations more efficient and scalable, and free up capacity to develop new use cases for existing data.

As the schematic indicates, the future state will be one where the four themes reinforce each other and produce a virtuous cycle of new use cases, which both breed and require more collaboration and technology based on common standards.

For this vision to work, organizations have to get three elements of their data operating model right:

- Institutions will need to establish robust foundational data management capabilities. These include building a thorough understanding and inventory of the data resources organizations have in-house, breaking down silos of data across the organization, and bolstering data quality practices.

- Institutions will need to build strong data governance, including the right set of data privacy and security standards, to make data collaboration with partners workable.

- Institutions will need to work together to establish trusted venues for experimentation and co-creation. If true interoperability is a goal, there needs to be willingness to evolve to industry-wide data models vs. firm specific. Firms should explore where there is mutual benefit from collaborative data environments with their clients, across firms or by leveraging industry service providers such as the DTCC. It will be important to start experimentation early and bilaterally to develop capabilities through discovery.

Building towards the vision of an ecosystem of data exchange will need to be prioritized, focusing on areas where there are biggest pain points and most willingness to collaborate – not on trying to achieve the future state for all data at the same time. Starting with reference data, such as client or security is a sensible starting point. These are the data sets that are needed across the industry, are not unique to a particular institution, yet currently have no common way to classify the data.

HOW THE FUTURE STATE WILL HELP PARTICIPANTS

Much about the future of data exchange and data management in financial markets is still being determined, of course. DTCC's hypotheses can serve as parameters for participants planning their strategies – not as hard and fast predictors of a certain future. The common theme in these hypotheses is that they will lead to a more accessible, connected, governed, and more flexible data infrastructure. Examples of how we see this happening include:

- **Data will be available over more than just point-to-point connections.** Instead, there will be a range of data exchange methods, including APIs, asynchronous publish/subscribe messaging, mapped to a central data infrastructure.

- **There will be an explosion of self-service distribution models and data exchanges, where data producers will publish data updates as they happen.** Data consumers will be able to retrieve these updates based on their own timelines, willingness to pay for specific data, and other business needs, rather than when it's convenient for data producers to load updates. In some cases, this may mean that users integrate so closely with data providers that they stop copying data into a financial institution's system, as the client simply begins to use the vendor's data stores as their own "golden source" of market information.

- **Data will be more customizable.** Specifically, it will be possible to transfer more granular sets of data, not necessarily dictated by pre-set message fields. Cloud-based data sets in shared database environment (or ledger) can be mapped to each other, allowing for seamless expansion of shared and connected data points. Decoupling of data from legacy into cloud-based model will reduce friction costs of finding, curating, provisioning data with appropriate controls. Logged and tracked analytics on aggregate information of sensitive data sets could then be used to extract signals and instructions for a firms own data environment.

- **Demand for data will continue to grow, matched by growth in supply and diversity of data available.** Shared and mapped sets of data will enable firms to allocate scarce resources to new data challenges that expand their product suite.

- **Providers will be expected to take accountability for data quality, privacy, and security.** Regulators and supervisors are focusing on making the increasingly digital economy secure. Customers' expectations will keep pace with regulators on these expectations.

- **Auto-translation of messaging formats will make it easy to plug specific data sources into new markets, networks and ecosystems.** Already, ZPI adaptors such as TransFICC and Xignite have emerged to facilitate more rapid communication between different APIs. At the same time, many legacy point-to-point connections will persist to accommodate data consumers who are transitioning certain systems more slowly.

- **Open-source data models will become increasingly important and will drive fierce competition in the face of broader data requirements.** Relevant parts of data producers' architecture, such as data models and metadata, will be exposed to data consumers. Some consumers will adopt models developed by data producers, creating a natural evolution toward harmonized approaches for most common types of data sets (especially reference data) and therefore reduce friction costs of acquiring and managing data.

- **Data privacy tools will evolve to allow sophisticated collaboration that preserves the data privacy of individual participants.** This would let organizations pool data to allow computations such as analytics models, while allowing each organization in such an arrangement to protect proprietary information.

- **Data operations and analysis will become more automated – and better.** We expect data operations will become more efficient and scalable through efforts made to modernize data management, such as efforts to improve data quality, rationalization and linking disparate data stores via an enterprise data taxonomy, use of APIs, cloud-based tools, as well as broader adoption of automation in data handling. Meanwhile, we expect that data analysis tasks, including data lineage, data discovery and integration, and data tagging, will also undergo change, to become either fully automated or, at the very least, greatly simplified by automated tools

DATA EXCHANGE TODAY

INTERNAL DATA

3RD PARTY DATA

END USER
APPLICATION

DATA PROVIDERS

#1 #2 #3
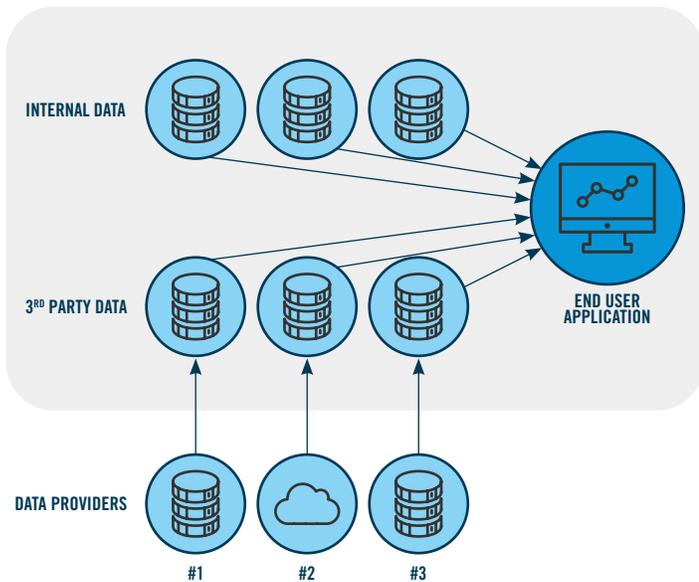
- An institution's data is organized in disparate data stores
- Data transferred point-to-point across data stores
- Data users copy 3rd party data into own data stores
- Burden of data interpretation is on the user of data
- Data handling is highly manual

HYPOTHESIS FOR THE FUTURE OF DATA EXCHANGE

INTERNAL DATA ECOSYSTEM

DATA PROVIDERS

#1 #2 #3
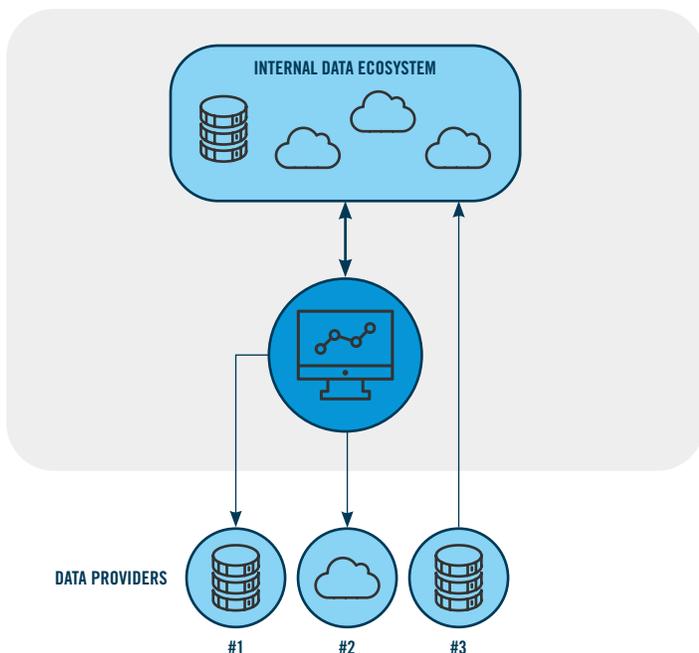
- ✓ Participants bring their own data together into a data ecosystem
- ✓ Flexible data access methods prevail
- ✓ Data producers expose data ecosystem to data users
- ✓ More data standards are open source
- ✓ Participants can choose to connect to others' data ecosystems as their own golden source (vs. copy data)
- ✓ Data handling is highly automated; capacity free to focus on insights

The result: Organizations will use freed-up computing capacity and staff time on higher-value work such as deriving insights, using the insights to better serve customers, to build new businesses, or even to optimize operations. But none of these benefits will happen by themself. Both data providers and data users must take steps to capture and maximize the improvement.

WHAT DATA CONSUMERS MUST DO

There are a series of steps data consumers should take to maximize the benefit of these trends. Some of the most important are:

- Make foundational investments in data technology to bring major data stores together across the organization.
- Strengthen capabilities to take in data such that the organization can handle modern forms of data exchange and, in more advanced applications, can handle auto-translation between different formats of data exchange.
- Double down on building robust data management capabilities, including implementing strong governance, control environment, and quality management program around data, that cover not just risk and regulatory data, but also commercial data.
- Acquire and develop analytics, AI and machine learning skill sets, by hiring data scientists, engineers and others.
- Invest in data privacy and security capabilities.

WHAT DATA PROVIDERS MUST DO

These likely market demands impose challenges that data providers should be preparing to meet quickly. These include:

- Modernize key elements of data technology to be ready to efficiently connect data across own organization, offer efficient and flexible access to the data, in a secure way.
- Experiment with making their own data ecosystem more discoverable and accessible via capabilities such as cloud computing and APIs to prospective clients and partners alike.
- Understand the value of individual data elements and where it could be enhanced through collaboration with clients or partners.
- Collaborate more closely with client consumers to develop data-driven applications.
- Curate customer groups and support them in developing shared data environments around your core data.
- Demonstrate that products protect the privacy of clients and their data.

LOOKING AHEAD

The most important part of the message we mean to send in this report, is that we are looking to build the future together with our clients and partners. It will take consultation and coordination. Many of the ideas here will be supplemented – and a few will probably be superseded – by insights we gain from our partners and clients, and through collaboration with them.

Let's begin that dialogue soon.

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