

DISRUPTIVE TECHNOLOGIES IN COMMODITY TRADING MARKETS

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CTRM Market Research, Analysis and Insights

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INTRODUCTION

Over the last few years, a host of potentially disruptive technologies have emerged that may yet have tremendous impacts on aspects of commodity trading and commodity supply chain business processes. These technologies join the shift to cloud deployment and software-as-a-service (SaaS) that we have observed taking on greater importance in the delivery of CTRM solutions recently. Technologies such as blockchain, automation, Artificial Intelligence (AI) and Machine Learning (ML), big data and social media, micro-services and open source software have all caught the imagination of software providers and industry players over this period. In particular, there has been a great deal of interest and considerable hype around blockchain and distributed ledger technology, while AI and ML are also seeing deployments in automated trading and elsewhere.

In addition to providing an overview of the changes occurring across the technology landscape, this Commodity Technology Advisory Disruptive Technology Study was devised and executed to establish how the wholesale commodities industry views these technologies, where and how they are being deployed, and to try to ascertain the level of threat these new technologies may pose to existing solutions and applications areas like CTRM software. ComTech conducted the survey component of the study using a web-based tool between December 2017 and early June 2018. Survey responses were encouraged through email, blog and word of mouth efforts including an email from the sponsor – FIS. The disruptive technologies survey had

82 valid participants with just over half of those being located in Europe.

All types of respondent were welcome to provide their views including vendor staff and in the end, the participants were largely and almost equally balanced from vendors or technology providers, Consultants and Industry end users.

Overall, the survey seems to be somewhat balanced in terms of the types of respondents; however, similar to other recent surveys that we have conducted, it has more Europe-based respondents than is perhaps representative of the industry in general.

4 Digital Game-changers for the EU Energy Markets



The rise of renewables, changing regulations, information overload, real-time trading trends and other factors impacting European power and gas markets are forcing many European Union (EU) power traders to reconsider how business will be conducted moving forward. Profits are not so easy to come by anymore. Many industry leaders are looking toward technology for answers. Where should they start?

1

Cloud Adoption and Software as a Service (SaaS)

Cloud migration and SaaS enable rapid innovation, business agility and a consumption-based business model that makes everything else work at scale. What's more, cloud computing facilitates "cloud native" applications and program deployment – a non-negotiable in today's fast-moving digital age.



2

Artificial Intelligence (AI), Machine Learning and Internet of Things

These newer developments combine to automate many functions crucial to success in the evolving energy markets. Real-time intraday trading, automated asset scheduling and optimization, smart grid management, and intelligent supply chain monitoring and maintenance are just a few capabilities to consider.



3

Blockchain

While not as mature as the other technologies on this list, blockchain is gaining ground in EU energy circles. It enables distributed ledger technology that builds trust between parties through guaranteed transaction security and verification. Pilot programs are now active in exchange platforms involving traders, producers and consumers; in back-office applications; and in connecting microgrids to wholesale markets.



4

Big Data Analytics

Big data, AI and analytics are set to transform the industry, with virtual power plants (VPP) being just one recent example. Operators have already applied the technology to combine small and medium-sized electricity producers with flexible consumers in a single VPP that's automatically monitored and controlled in real time. Drones support the operation, collecting images that help the network during outages.



As these technologies and others become mature and accepted across the continent, early-movers can gain a decided advantage. Stay one step ahead by reading our new report [Digital Innovation in European Power Trading](#) and rise to meet the future faster.



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AN INDUSTRY BUFFETED BY CHANGE

In the last decade, the commodities industry has been experiencing significant change from a variety of influences and on multiple fronts. These include, but are not limited to:

- Increased and intensified regulatory and stakeholder oversight – In the wake of the financial crises of 2007/2008, new regulations have arisen, particularly in Europe and the US, that directly impacted most players in commodity markets. These new regulations, ranging from regulations like MiFiD2, EMIR and ReMIT in Europe and Dodd Frank in the US, to issues such as the Trade Facilitation and Trade Enforcement Act of 2015 (TFTEA) were designed and implemented to better ensure a fair and competitive trade environment. Unfortunately, their impacts have been a bit uneven and have required significant changes in the way in which commodity-centric organizations manage and track their activities. For example, TFTEA prohibits all products made by forced labor, or child labor, from being imported into the United States – requiring operational vigilance and traceability of all transactions throughout the supply chain. Other regulations, both existing and emerging, focus on other aspects of trade, such as sustainability (green energy), have and are dictating similar changes. In total, since the global financial crisis, a raft of regulations and new shareholder requirements (particularly from trade finance banks) have emerged that have particularly targeted trading – requiring “proper” and visible risk management techniques, reporting of trades to regulatory bodies, establishing limits on trading positions and prohibiting certain trading practices that could be deemed as manipulative. Few

corners of the commodities supply chain, from source to consumption, have been left unaffected by these changes - adding significant complexity, operational risks and incremental costs to all market participants involved in the procurement, sale, movement or use of commodities,

- Geopolitical risks have exploded in recent years and months, impacting commodity prices and shifting global trading patterns. These risks and uncertainties include the still emerging impacts of BREXIT, increasing tensions between the US and Iran (including the abandonment of the Iranian nuclear deal and imposition of oil export sanctions on that country by the Trump administration), the tenuous cartel-like relationship between OPEC and the Russians, and the increasingly protectionist trade measures primarily by the United States and the increasing potential for trade wars. All the while, continuing economic chaos in Venezuela and ongoing military conflicts in Syria, Yemen and elsewhere continue to add to the uncertainty - driving increased price volatility, shifting supply chains, increasing costs and creating greater risk for all commodity traders.

- The rise of renewables has had a large impact on energy trading in many locations, but particularly in Europe and the US, where, in both geographies, the generation mix has become increasingly reliant on

unpredictable renewables and less reliant on fossil fuels, even for baseload generation needs. Despite the United States withdrawal from the Paris Accord and the country's loosening of some environmental regulations aimed at assisting the coal and oil industries aside, renewables continue to contribute increasing amounts of power globally, and are forecast to continue to do so. This influx of renewables, primarily wind and solar, has led to significant structural changes, including the break-up of large utilities keen to spin-off highly exposed "dirty" generation assets. With continuing regulatory and national economic support of these new power sources, significant knock-on impacts are occurring – increased attention to short-term and real-time power trading as price volatility increases, the rise of distributed power generation and the producer-consumer (prosumer) market, and the need to better automate and strengthen distribution grids.

- Continuing market liberalization in Europe and the previously noted regulation of gas and power markets on the continent are forcing traders to move away from bi-lateral OTC transactions and towards exchange-cleared or exchange-based trading – resulting in increased price visibility and reduced basis/arbitrage opportunities even as cross-border trading activity in the region increases with the build-out of the infrastructure and mechanisms to support increased trading activity across country borders.
- As trade margins shrink and profits become harder to come by, market participants are now focusing on

other opportunities to bolster financial performance – including improvements in supply-chain efficiency via asset optimization, increased activity in short-term/real-time trading markets and renewed attention to reducing operational risks and costs. These, in turn, have further contributed to structural changes across the industry as merchants and traders have sought out non-traditional services to help bolster profitability. These include the securitization and decentralization of power generation assets, addition of specialized data services and even providing direct market access via web-enabled, digital platforms,

- Data is now everywhere. While regulation and market liberalization has catalyzed a vast explosion of data by forcing increased market transparency (including the publication of vast amounts of timely pricing data), technology has given rise to a growing flood of web-based, electronic information (including social media) throughout the industry. Accessing and leveraging this sea of data via improved data management and visualization technologies is now a critical capability in managing risk, recognizing opportunity, improving profitability and growing shareholder value.

Although this list is obviously not a full and comprehensive accounting of the many defining changes occurring in these markets, it is sufficient to demonstrate that today's commodities businesses are facing not only market transformation, but also unprecedented uncertainty. That said, there is an additional set of changes taking place that represents both a threat and also an opportunity – that of technology.

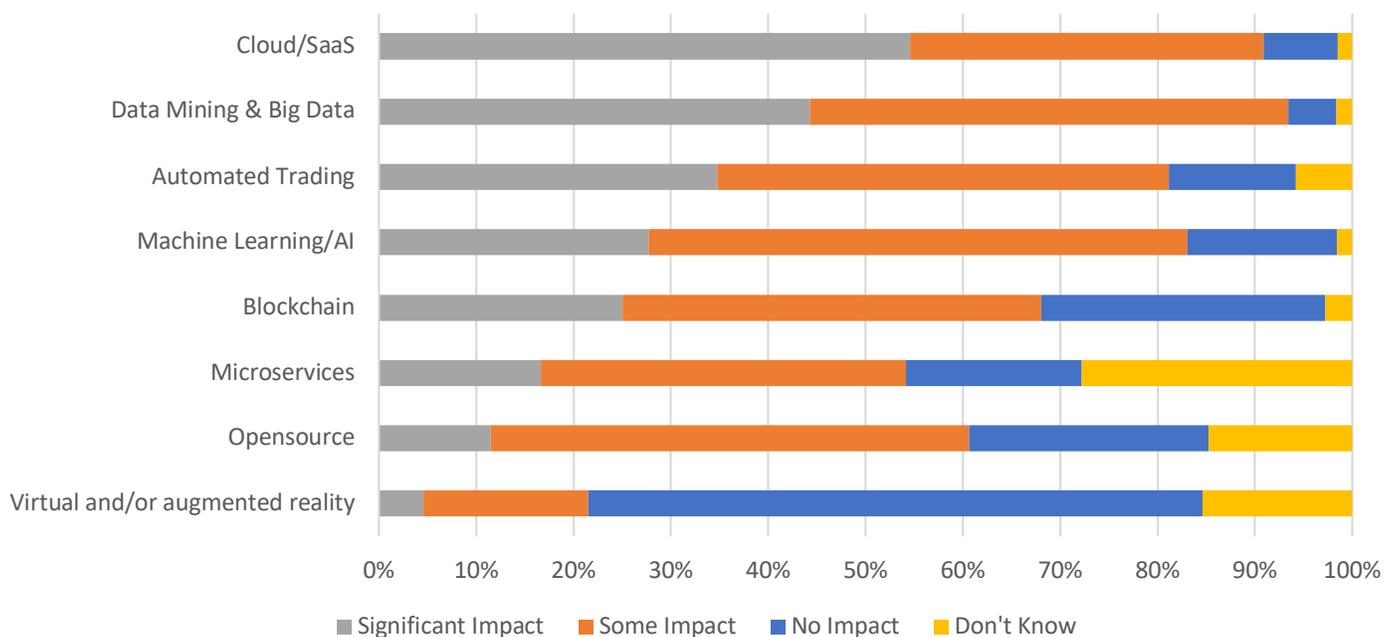
THE TECHNOLOGY CHALLENGE AND DISRUPTIVE CHANGES

A Summary View

For the last several years, the way CTRM and supporting solutions are deployed has begun to shift from traditional, on-premises deployments to the cloud. ComTech has monitored, tracked and researched this trend¹ from its inception and notes that a majority of implementations now take place in the cloud² – either as hosted in the cloud or as multi-tenanted, cloud-native, solutions. At the same time, the way software is paid for has begun to shift from a traditional perpetual license fee, customization fees,

annual support & maintenance to a recurring (monthly or annual) all-in usage fee. Unsurprisingly, our current survey data shows that the respondents see the migration to cloud and SaaS as having the most potential impact on the industry over the next 12-24 months; and, with over 75% of those respondents saying this is an area of greatest current investment, it is the area that is most likely to continue to see investment in the near future (Figures 1 and 2).

Figure 1: Technologies Likely to Have Most Impact on Commodity Trading Over the Next 12-24months



¹ <https://www.ctrmcenter.com/publications/reports/ctrm-cloud-research-report/>

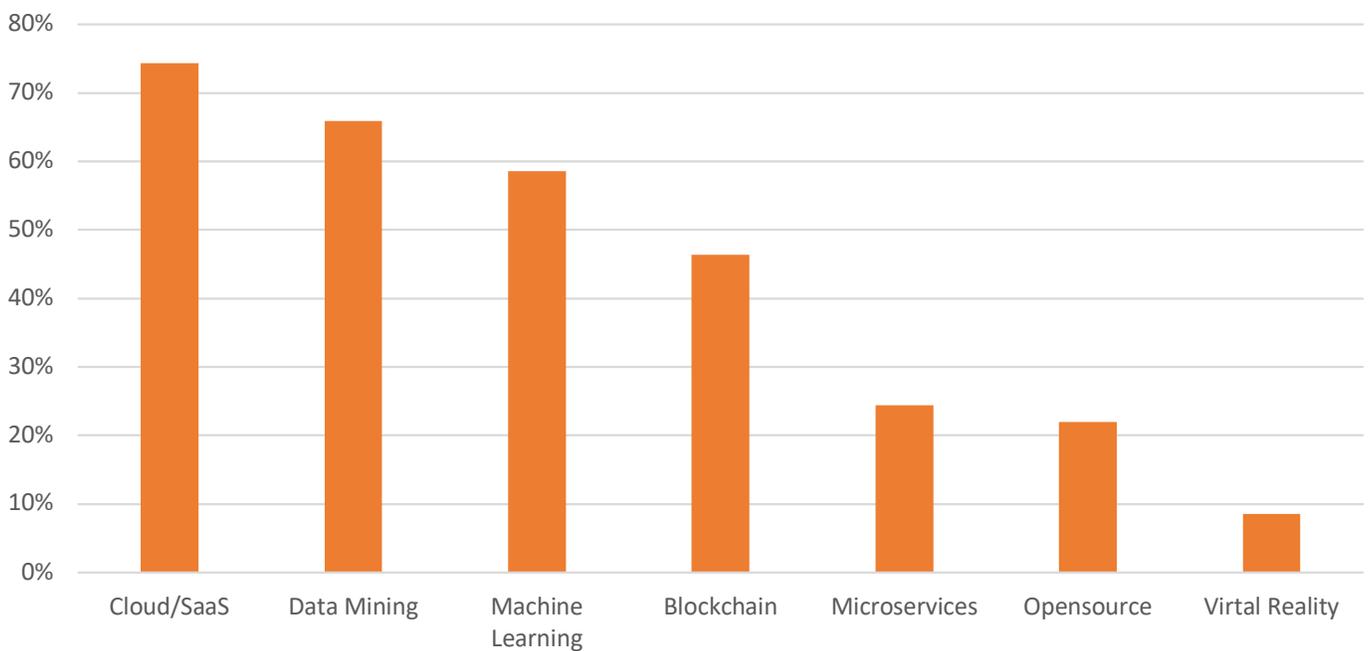
² <https://www.ctrmcenter.com/publications/reports/2016-2021-ctrm-market-outlook/>

Data management has also become a topic and focus of greater importance in recent years, and many firms in the space have spent considerable time and budget redefining their data management strategy and architecture. Analyzing massive data sets, including “big data” requires the ability to visualize it in order to make business decisions...so user interface design and visualization tools have also become significantly more important. Indeed, this is the second most important area of disruption seen by the respondents

over the next 12-24 months (Figure 1) as well as the second largest area for investment (Figure 2). In fact, if responses indicating “significant” and “some” impacts are summed, it could be argued that this may be the most impactful technology according to the respondents (Figure 1).

Being able to deal with vast amounts of data in near real-time is also an area in which Machine Learning (ML) and Artificial Intelligence (AI) are seen as hav-

Figure 2: Investment Plans over the Next 12-24 Months



ing application. ComTech sees AI and ML as having broad applicability in a number of diverse areas, including predictive maintenance, optimized production, automated trading, and even in software testing. In the survey, the respondents found ML/AI and automated trading to be the third and fourth most important area of impact in the near future in the indus-

try and the third largest area for investment (Figures 1 & 2).

Distributed ledger technologies, known more commonly as blockchain, are perhaps the most talked about technology at the moment. However, despite much hype around the technology, most investment

in the commodities space is in proofs of concept or investigative. Despite the availability of few production-ready solutions running blockchain, it's clear that distributed ledger technologies have a range of potential applications in the energy and commodities markets - from supply chain management to peer-to-peer trading. That said, while it is likely that blockchain or some derivative technology will eventually mature to become a disruptive technology, we believe that is perhaps too early in the development cycle for broad commercial deployment - a view apparently supported by the survey data. In our survey, the respondents note a much lower level of importance for the near future, as well as the lower level of investment in the

blockchain when compared to cloud, data mining or ML (Figure 1 & 2).

Other technologies, in various states of maturity, could have disruptive impacts, including virtual or augmented reality for better visualization and interpretation of large and complex data sets, the use of drones to collect near real-time field intelligence, and quantum computing providing improved modeling and optimization opportunities. However, based on our survey results, these seem further away in the future or are believed to have more limited usefulness as the respondent's ranked all significantly lower on the scale for both short-term impact and investment (Figures 1 & 2).

BEACON CTRM: THE ENTERPRISE INNOVATION PLATFORM

Machine learning

"Incorporating machine-learning techniques and tools into their applications."
risk.net

Digitization

"Beacon delivered a digitization project for us with tangible business benefits. This is unique amongst the many digitization initiatives across our company."
Trading desk head, integrated oil major

Agile continuous delivery

"Beacon enables our internal developers to focus on creating value for the business by responding to commercial requirements in real-time."
CEO, Javelin Commodities

Full-Stack

"A modern, cloud-enabled, real-time agile environment in which all trading and risk functionality can be developed, deployed and kept up to speed."
ComTech Advisory

Transparent source code

"The transparent source code allows us to customize the platform and develop proprietary pricing models directly in the system."
Head of Axpo US

Apps

"Beacon provides sophisticated analytics for VAR and XVA out-of-the-box."
Head of Software Development, Javelin Commodities

beacon **ACCELERATE TECHNOLOGY**

RiskTech 100
2018 Rising Star

Risk.net
Market Technology Awards
Winner 2018

Beacon Platform
Pricing and analytics
Structured products/
cross-asset

Risk Awards
2017 Winner

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of the year

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Cloud and Software as a Service

Despite initial resistance in the industry to the cloud and cloud deployment, we now see cloud and software as a service (SaaS) adoption growing rapidly in all geographies and across all segments of the industry - though perhaps led by the Asia-Pacific and European regions. A few vendors such as Aspect and OATI for example, have championed cloud-delivered CTRM for more than a decade, only to have been joined by a host of newer solution providers over the last 5-years or so, seeking to take advantage of the low and lower mid-tiers of the market - the 1-20 user customers that have typically comprised the bulk of the cloud-based CTRM market. However, with the announcement by industry leader OpenLink in the spring of 2017³ that they were re-architecting their Endur product to run in the public cloud, cloud delivered CTRM has now reached the top tiers of the market as well. Now, virtually all vendors offer a 'cloud' variant of their software as well, though many are "hosted in the cloud".

The term "hosted in the cloud" does point to an issue with cloud with respect to its definition. A recent CTRMRadio podcast⁴ examined this issue in some depth and it did seem as if there were a level of agreement amongst the panelists we spoke with that cloud ought to mean cloud native software delivered in a multi-tenanted manner...essentially SaaS; however, much of the current 'cloud' CTRM deployments are in fact single tenanted hosted in the cloud solutions. While there are plainly advantages to each approach

(multi-tenanted vs. single), the highest level of benefits of cloud (lower costs and seamless upgrades for example) can likely only be gained from a cloud-native solution delivered via multi-tenanted software. Despite this somewhat technical discussion, the fact is that the cloud deployment of CTRM solutions has forever changed the licensing models of the software - and the vendor's revenue models - as most new deals are based on periodic usage fees as opposed to perpetual license fees that were once the rule.

ComTech expects licensing revenues from all types of cloud deployments of CTRM and related software to grow at a rate of 10-15% over the next several years, outpacing the overall growth rate of spending for the category at 3-4%. This movement to the cloud is, in itself, a disruptive impact on the CTRM software space as it provides an entry point for smaller firms to procure a commercial CTRM solution for the first time on a relatively cost-effective basis. As these smaller firms will seek out the lowest price options available, we anticipate, at least in the short-term, some erosion of market share from the top vendors to the cloud-native solutions from younger, smaller vendors that have developed their solutions as cloud capable from the ground-up.

Again, the survey data unsurprisingly shows that cloud/SaaS is an important investment area in the short-term and is regarded as having the most impact (Figure 1 & 2) by the respondents.

³ <https://www.ctrmcenter.com/blog/vendor-news-blog/openlink-rolls-cloud-strategy/>

⁴ <https://www.ctrmcenter.com/media/podcasts/ctrmradio-edition-2-ctrm-in-the-cloud/>

Data, Big Data, and Data Management

Data is everywhere and in almost every format. According to IDC⁵ the digital universe is set to reach 180 zettabytes (180,000,000,000,000,000,000,000 bytes) by 2025 as data creation and capture accelerates...in fact, more data has been created in the last 20-years than in the whole prior existence of mankind. Unfortunately, much of this data is not contained in structured lists residing in relational databases, but rather is unstructured in the form of photos, videos, social media content, and more. Web-enabled devices, ranging from smart consumer products to sensor-enabled field equipment, are increasingly common and important sources of data, and as the Internet of Things (IOT) expands, so too will the amount of data – all of it increasingly in near real-time. And as data and data sources increase in quantity, heightened concerns regarding the security and use of that information are growing as well – resulting in a number of new and emerging regulations around the globe regulating how data is captured, stored and used, including data associated with industrial activities such as commodity trading. That said, many regulations, including Dodd Frank and REMIT/MIFID, have forced increased market transparency across parts of the commodities complex, resulting in increased availability of data to inform decision making.

Highlighting the increased importance of data, Thompson-Reuters⁶ reported last year that in a

survey of over 700 commodity professionals, more than 60% of those surveyed expected their firms to increase budgets for data management, driven by a need to cut total cost of ownership, centralize data, reduce operational risk and create an analytics platform to better manage growing complexity in data management.

Data is now the life blood of commerce; and in commodities, data is the essential ingredient for the tools of decision making and trading, including analytical models, predictive models, and high-frequency trading.

Over the past couple of years, even as CTRM software sales and deployment slowed, ComTech was observing increased market attention and expenditures on data management strategies, including data capture, storage, integration, retrieval and visualization. This increased focus and spend may have contributed to delayed CTRM procurement activity as a coherent architecture and data management strategy is increasingly viewed as a critical precursor to deploying other key solutions such as CTRM software. Driven in large part by the increased market awareness of the criticality of data management tools, we have seen increasing M&A activity in the data management space for energy and commodities. For example, Drilling-info has, within the last couple of years, acquired a number of data-centric firms, including Datagenic,

⁵ <https://www.forbes.com/sites/michaelkanellos/2016/03/03/152000-smart-devices-every-minute-in-2025-idc-outlines-the-future-of-smart-things/#61b8236d4b63>

⁶ <https://blogs.thomsonreuters.com/financial-risk/trading/drilling-for-data-gold-who-has-the-tools-for-commodities-success/>

Pattern Recognition Technologies, Marketview, and others...before itself being recently acquired by Genstar Capital.

For respondents in our survey, big data and data an-

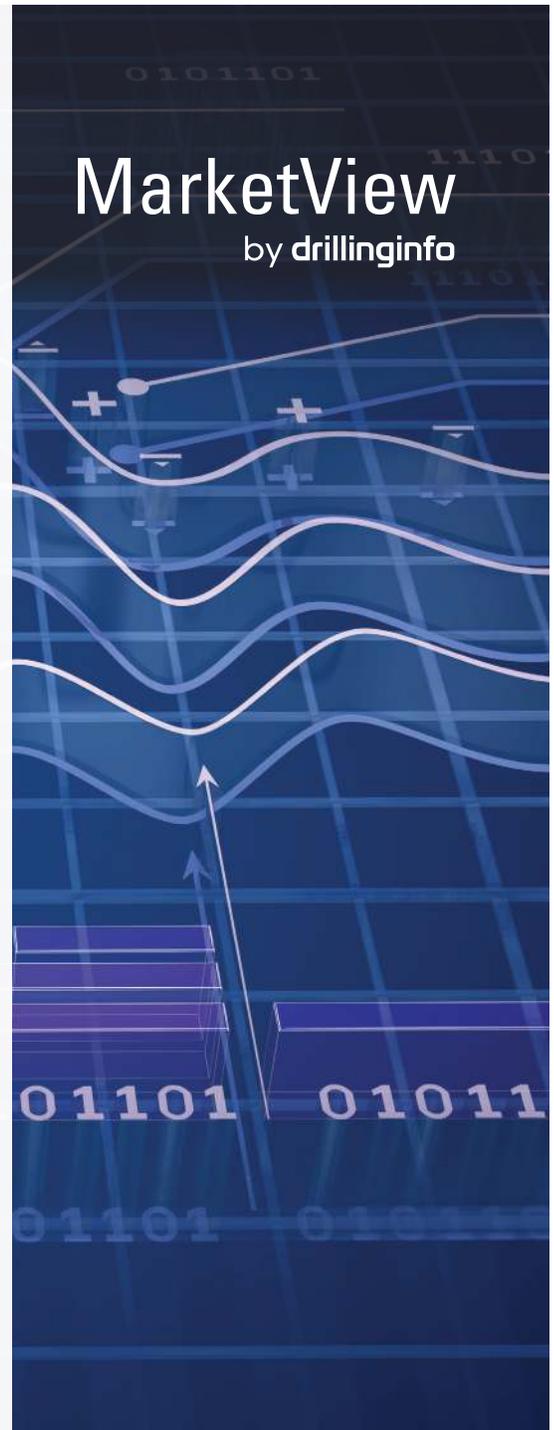
alytics were viewed as having the second greatest short-term impact, and as being an area for increased investment. It was also seen by 65% of all respondents as the area most likely to bring the most disruption to the market over the next 2-3 years (Figures 1 & 2).

REAL-TIME. REALLY.



view of energy commodity data
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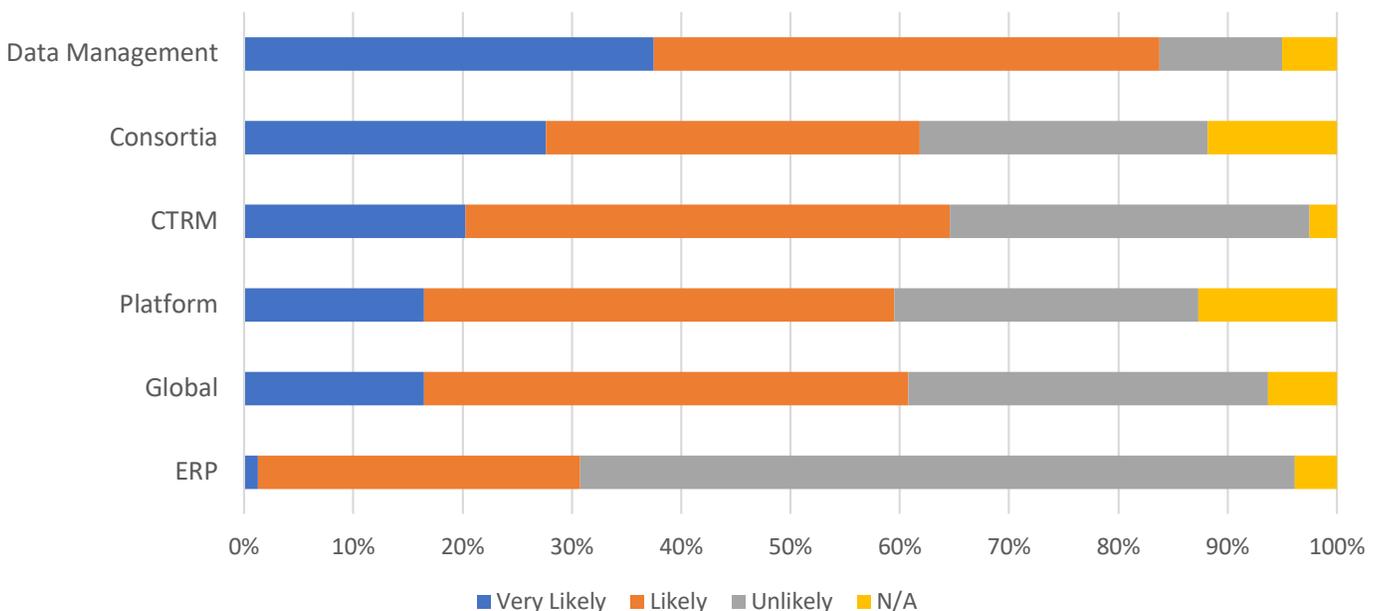
Looking specifically at the management of the flood of data now available, data management solutions and strategies will continue to be an area of significant investment and rapid growth for the foreseeable future as firms try to find ways to collect and analyze all types of data - from prices to unstructured data. Given that the quality and accuracy of this data can be highly variable depending upon its source, work often needs to be performed to validate, check, convert, and derive calculated values. When it comes to consuming data, three things are important – automation (for collection and validation), visualization and real-time capabilities.

Leading commercially available data management tools can be used to collect and verify data via rules-based automation. With such tools, users are able to programmatically capture, verify and transform data while maintaining a comprehensive audit trail. That

said, without the ability to visualize data in its various dimensions, these big data sources can be of little value. Emerging developments in visualization tool-sets, including virtual and/or augmented reality devices, may hold the key to make better use of these immense data resources and provide competitive advantages to market participants. However, interest in these technologies for commodities traders lags other areas, with (as previously noted) less than 10% of our respondents currently planning to invest in VR over the next 12-24 months (Figure 1).

Given the increasing focus on data in the commodities markets, it's unsurprising that the survey respondents identified data mining and data management vendors and providers as the most likely source for bringing disruptive technologies/solutions to market in the next 2 – 3 years (Figure 3).

Figure 3: Over the Next 2-3 Years, Which group of technology/solution providers stand the best chance of developing or bringing disruptive solutions/technologies to market?



A Role for Social Media?

Social media have become a very popular medium and arguably a relatively untapped source of potentially useful intelligence for commodity businesses. Twitter and industry expert blogs are already utilized in other asset classes, such as equities, to provide traders with both trading signals and sentiment analysis.

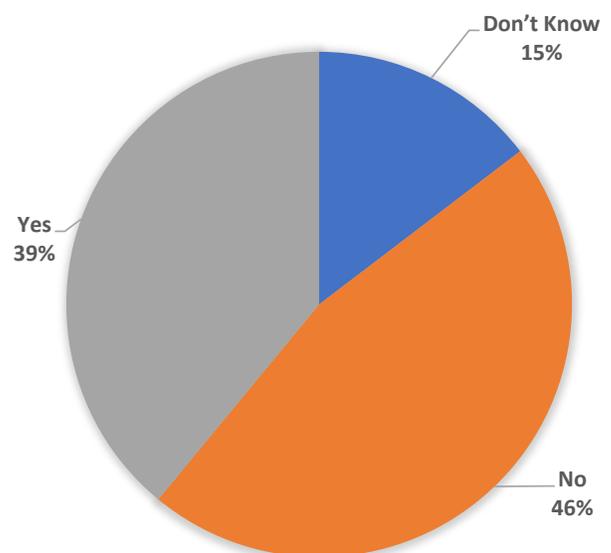
Unfortunately, the flood of data and information pouring onto and out of platforms such as Facebook and Twitter - with the vast majority of it being nothing more than “noise” comprised of uninformed opinions, unfounded rumors and personal experiences – can limit its appeal and usefulness to commodity trading professionals. However, given the ubiquitous nature of social media, its potential value cannot be dismissed. Social media, is now, in almost all cases, the first source to identify events or trends that could impact demand or availability of commodities - such as localized severe weather events and other emergency conditions tweeted by residents or first responders. Events such as industrial accidents, civil unrest or transportation disruptions in a producing area can impact commodity production, deliveries or demand...with knock-on effects on price movements or contractual deliveries.

Recognizing the potential value of social media as an information source, there are a number of companies offering social media derived data products - and a number of generic news platforms are now incorporating these tools. Additionally, software products

are now available to help traders make use of social media, including tools to automate trading based on sentiment analysis.

Social media platforms, like Twitter, along with conventional news sources and unconventional news sources like blogs, can have value in sentiment analysis and in identifying buy/sell signals, especially when used in combination with traditional data. However, separating the noise from the valuable signals requires filters, such as the ability to know what keywords to track and where to track them. Without dedicated tools, this task would be, at worst, impossible or, at best, not cost effective.

Figure 4: Does Social Data Mining Have Any Interest to Your Firm?



ComTech does expect social media to play a future role in the commodities industry particularly around

sentiment analysis and near real-time incident identification. However, despite its potential value and the attention that social media has garnered over the last

decade, relatively few respondents (only 39%) indicated that their businesses are currently interested in social media data mining (Figure 4).

#1 Two Years In A Row

EnergyRisk Software Rankings 2018 Winner

ETRM software provider
Best cloud-based CTRM/ETRM system

Aspect
Enterprise Solutions
An ION Investment Group Company

Switch To Aspect Cloud.

No-Risk Free Trial
aspectenterprise.com

Machine Learning/Artificial Intelligence

Machine Learning (ML) and Artificial Intelligence (AI) have significant potential to transform, via intelligent automation, the various business processes and operations in commodities; and the respondents rated this category quite highly as both an area of impact and investment over the next 12-24 months (Figures 1 & 2); and were viewed as having the second greatest chance of disrupting or having significant impact on business processes (Figure 5).

ML and AI are viewed by most market observers as hand-in-hand solutions for addressing the vast amounts of data that the industry generates and can now access – providing a wealth of detailed information from production to consumption for almost all commodities for those that can access, analyze and act on it.

As an example of the growing interest in data science and ML, Cargill⁷ is reportedly building ML models for agriculture, food and commodities. As noted, Cargill sees ML as having application across a range of areas – from optimization of shipping routes and satellite image analysis to examining crop yields, to even the interpretation of acoustic recordings of shrimp eating, informing shrimp farmers when to add more fish feed.

Numerous other commodity-centric businesses are investing in AI and ML across a number of functional areas - including applications for automated and algo trading, optimized hedging programs for improved risk reduction and portfolio optimization, FX trading, and demand forecasting. For example, AI is being deployed by the National Grid in the UK in a program

⁷ <https://www.ft.com/content/72bcbbb2-020d-11e8-9650-9c0ad2d7c5b5>

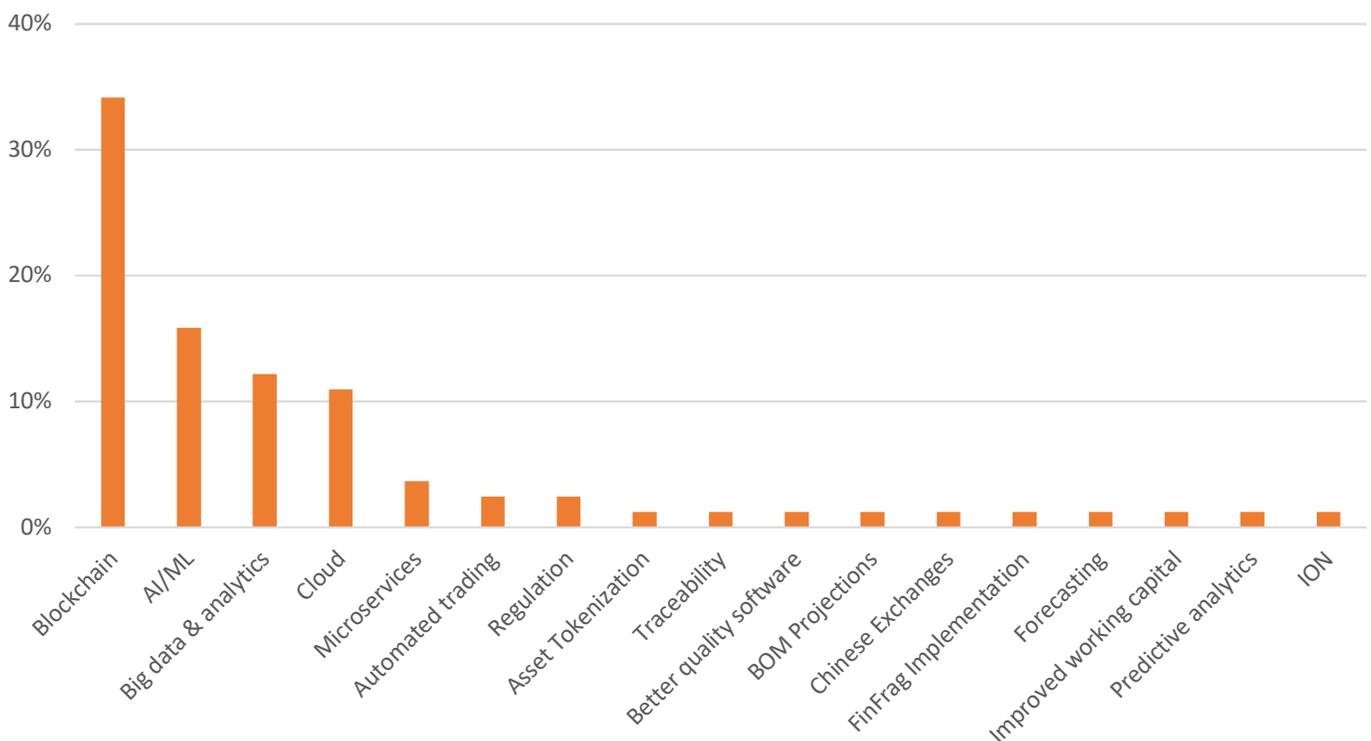
that integrates technology from Google-owned AI company DeepMind to improve the power network’s transmission efficiency by as much as 10%. Given the increasing amount of unpredictable renewable generation, National Grid must maintain the frequency of the grid within a relatively tight band of values, and being able to process massive amounts of data and utilize AI powered predictive models can proactively address surges in demand or instances of oversupply.

Automated trading is now catching on in commodities and according to the CFTC, represent over 60% of crude oil trades and more than 50% of metals and Ags trades on the CME⁸. Larger traders, who have

seen margins erode, are now focused on gathering data on an unprecedented scale and then running ML algorithms on that data to find patterns linking fundamentals to price. This increased attention and investment in algo trading has resulted in a massive increase in demand for data scientists and other data-related skills across the industry.

Another area of innovation in Europe where AI, automation, analytics and other technologies are being deployed is in the creation of virtual power plants. In one initiative, Next Kraftwerke, a virtual power plant operator and energy trader, combined small and medium-sized electricity producers with flexible electricity consumers in a single European-wide Vir-

Figure 5: What do you believe, from a technology standpoint, has the largest potential to disrupt commodity trading & risk management business processes?



⁸ https://www.cftc.gov/sites/default/files/idc/groups/public/@economicanalysis/documents/file/oce_automatedtrading_update.pdf

tual Power Plant (VPP). The VPP includes biogas and combined heat and power (CHP) plants owned by local farmers on the production side, and flexible pumps, ventilators and compressors on the consumption side and the whole VPP is monitored in real-time and automatically controlled by algorithms. There are other examples of German companies following the same path.

One issue with AI is that it is computationally intensive. However, cloud computing is facilitating the deployment of AI by offering some of the computational flexibility that is needed. In the future, quantum computing may aid deployment and allow increasingly sophisticated models.

Exploiting the IOT is another area of interest for many firms in the industry. Deploying smart devices in industrial facilities such as power plants, enables the collection and analyzing of constant streams of highly granular data to ensure increased reliability and optimized operation.

Coupled with AI, these types of facilitate may be able to move to more event-driven operations, allowing real-time adjustments to more effectively and efficiently operate in rapidly a changing environment.

The growing interest in AI and big data in the energy industry has catalyzed a number of mergers and acquisitions in which energy and commodity companies have invested in or acquired specialist AI firms. According to a report from accounting firm, BDO⁹, mergers and acquisitions involving energy companies

and AI startups soared in average value from around \$500 million in the first quarter of 2017 to \$3.5 billion in the second quarter. In that report, BDO state that *“AI will allow a transition to an energy portfolio with increased renewable resource production and minimal disruptions from the natural intermittency that comes with these sources due to variable sunlight and wind intensity.”*

The results of our survey and research do suggest that AI and ML, when combined with big data and to some extent, the cloud, is set to have a dramatic impact on commodity technology in the near-term.

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European Power and gas operations & logistics web application

- Nominations
- Balancing
- Assets scheduling
- Automated trading
- Strong interoperability
- Time series based
- High availability

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⁹ <https://www.bdo.co.za/getmedia/9b39ded6-e999-434d-af9a-5e073db1285c/BDO-Renewables-and-artificial-intelligence.pdf.aspx>

Blockchain

Blockchain (also known as distributed ledger technology) has become a buzz word that attracts a lot of interest, but is it really mature enough for broad commercial acceptance and deployment in the commodities markets?

Though interest in this market is high and investments are being made, much of the activity at the moment is in the form of proof of concepts, though there are a number of commercial offerings as well. Experiences to date have shown that, while still rapidly evolving, there are performance concerns, high development costs, and concerns related to developing the consensus business models that will govern all participants in any market or application built on blockchain. These issues, and perhaps others, may be reflected in the results of our survey (Figures 1 & 2) that show perhaps a healthy degree of skepticism in the short-term around blockchain investments. Nonetheless, our respondents do indicate that they see blockchain as the technology most likely to disrupt business processes (Figure 5 above).

Much of the current commercial development in commodity trading and financial market blockchain solutions have been via consortium efforts and are generally focused in the following areas:

1. Peer-to peer trading – both wholesale and in local prosumer markets
2. Smart contract enablement
3. Trade finance
4. Post-trade processing
5. Tracking of ownership
6. Provenance tracking/traceability.

There are a number of these consortium efforts targeting specific areas of the commodity supply chain, including peer-to-peer trading platforms and applications to track ownership, ensure traceability and enable smart contracts. It is more or less impossible to document all of these initiatives currently underway however, a few of the more important ones are:

- VAKT, created in late December 2017, includes participation from a group of oil companies and banks including BP, Equinor and Shell, Gunvor, Koch Supply & Trading, Mercuria, ABN Amro, ING and Société Générale, who contributed capital to develop an industry-wide solution in post-trade processing for commodities via blockchain.
- Easy Trade Connect - The Easy Trade Connect (ETC) platform, which was initiated by ING, has been subject to testing by a number of global trading firms. More specifically, Louis Dreyfus piloted a POC focused on agricultural products such as soybeans and involved a shipment of soybeans from the U.S. to China, with all of the relevant documentation (including the sales contract and the letter of credit) existing within the platform.
- Enerchain – a blockchain-based distributed ledger targeting energy trading and covering the entire trade cycle commenced in May 2017 with 23 participants and now has over 40 companies involved

including Alpiq, Eon, Total, RWE and many others. Developed by Ponton, its focus is on power and gas spot and forward markets in any European delivery zone. The proof of Concept ended in March 2018¹⁰ and the initiative is now in the process of forming a legal entity and agreeing on a set of contracts between participants.

- Arkratos - a Singapore company linked to trading house Rhodium Resources, recently launched Kratos, a commodity trading platform, after trialing it with four traders based in Dubai, Hong Kong, Malaysia and Singapore. The system uses blockchain technology and self-executing smart contracts that cannot be manipulated or duplicated.
- EnerPort was launched at the International Energy Research Centre (IERC) Annual Conference in early 2018. It will seek to accelerate peer-to-peer energy trading in Ireland through blockchain technology. Led by the IERC, and in partnership with SFI's INSIGHT Centre at NUI Galway, EnerPort also involves a number of indigenous companies including Systemlink Technologies, MSemicon, and Verbatm.
- Tiqpit Solutions Ltd is an independent blockchain commodity trading platform developer that recently processed orders and trades in a simulated market environment using the trading module tiqpit-platform, a prototype based on distributed ledger technology (DLT).
- In December last year, EPEX SPOT also announced an initiative aimed at connecting microgrids to the wholesale market using blockchain in partnership with LO3 Energy. According to the

announcement, the first realization of this partnership will involve pilot projects in Europe and the LO3 technology will be deployed in community microgrids where the two partners will connect these local peer-to-peer markets to the EPEX SPOT wholesale markets.¹¹

- In January 2018, Maersk and IBM also announced the formation of a joint venture applying blockchain to improve global trade and digitize supply chains.
- In July 2018, ConsenSys and cloud-based metal concentrates exchange - Open Mineral, announced a joint venture to establish Minerac, a blockchain consortium for mineral commodities trading and connected supply chains operations. A number of mining companies and financial institutions will join as stakeholders and collaborators.

In fact, hardly a week goes by without some new start up focused on blockchain in commodities or some new pilot, consortium or initiative is announced. Among others that ComTech has tracked are blockchain companies like Skuchain and Everledger, both developing solutions that can track commodities (such as avocados and diamonds) from source to point of sale. The Batavia platform in Europe is a global trade finance platform built on the IBM Blockchain Platform and is being collaboratively developed by a consortium of five banks – UBS, Bank of Montreal (BMO), CaixaBank, Commerzbank and Erste Group – and IBM. Also in Europe, the we.trade blockchain consortium is expected to go live imminently. Banking concerns Deutsche Bank, HSBC, KBC, Natixis, Nordea, Rabobank, Santander, Société Générale

¹⁰ <https://enerchain.ponton.de/index.php/34-key-insights-report-of-the-enerchain-poc>

¹¹ https://www.epexspot.com/en/press-media/press/details/press/LO3_Energy_and_EPEX_SPOT_join_forces_to_connect_local_microgrids_to_the_wholesale_market

and Unicredit are involved in this project, which uses Hyperledger Fabric technology, and which spans 11 European countries.

Some of these new initiatives intend to use the concept of an Initial Coin Offering (ICO) to raise funds in which cryptocurrencies are offered to early backers in return for legal tender or other cryptocurrencies. According to PwC¹², some \$13.7 billion has already been raised in this manner so far in 2018, yet over 1,000 such projects have already failed globally this year. However, there are calls for increased regulation of the ICO mechanism. Given the hype and investment pouring into these markets, the analogy with the dot com era is easy to make. In fact, the FCA¹³ is already investigating a number of cases and seems set to take action.

There are already skeptics emerging who see blockchain as nothing revolutionary, and question its cost and scalability¹⁴ particularly for peer-to-peer trading... instead they expect blockchain to become an embedded technology where it has specific use. With a maximum speed of 7 transactions per second, how could blockchain meet the required performance of a commodity market and at what cost per transaction? Meanwhile, GlobalData¹⁵, expects the hype around blockchain projects to sharply decline through 2018 as the costs and complexities become better understood.

Despite that, most of these areas of interest for blockchain development have impacts on how data captured or processed by the CTRM, CM and ERP solutions; so, it's perhaps not surprising that our respondents believe that it these types of vendors that stand the largest chance of being disrupted by blockchain in the future (Figure 6). Over 60% of those answering our survey believed E/CTRM vendors will be disrupted and over 40% saw a similar fate for ERP software providers.

However, blockchain-based, proofs-of-concept still face significant challenges, including concerns about their performance to match and settle trade transactions in volume, difficulties around the legal definition of what is the venue (a de-centralized, peer-to-peer structure makes it difficult to define a centralized venue operator and some level of governance is still required), cost considerations, and a host of other critical concerns around regulation, regulatory reporting, and developing consensus around processes/business constructs by potential members. Certainly, one of the key advantages of blockchain is that it eliminates the need for a "trusted" intermediary and in doing so, eliminates fees and other costs needed to support that intermediary. However, in eliminating that intermediary, one needs to understand how that system will be governed and maintained - who will manage the peer-to-peer venue? Other questions without obvious answers include: where will E/

¹² <https://cointelegraph.com/news/pwc-report-finds-that-2018-ico-volume-is-already-double-that-of-previous-year>

¹³ <https://www.lexology.com/library/detail.aspx?g=7998fd47-2196-4f34-a284-5d41235b285a>

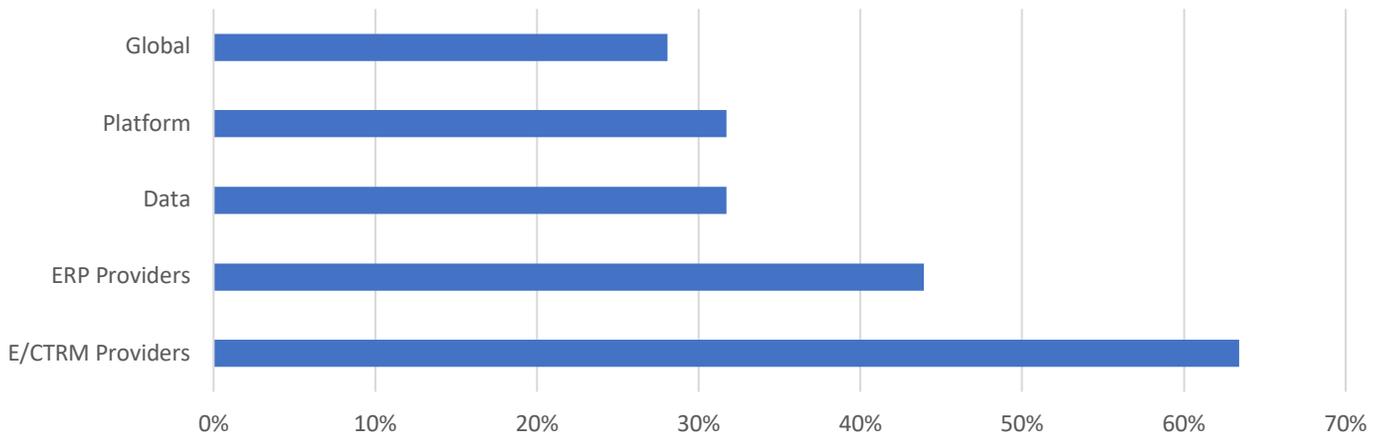
¹⁴ <https://www.greentechmedia.com/articles/read/blockchain-might-not-be-best-for-energy-trading#gs.4RnAyuM>

¹⁵ <https://www.greentechmedia.com/articles/read/whats-next-for-energy-blockchains-as-ico-hype-fades#gs.2Sru2CQ>

CTRM software sit in relation to these initiatives, and how will the current centralized energy marketplace providers actually respond? It remains early days for these technologies, most of which are provided by

smaller vendors, and the regulators have yet to have their say in how they might be viewed and regulated going forward.

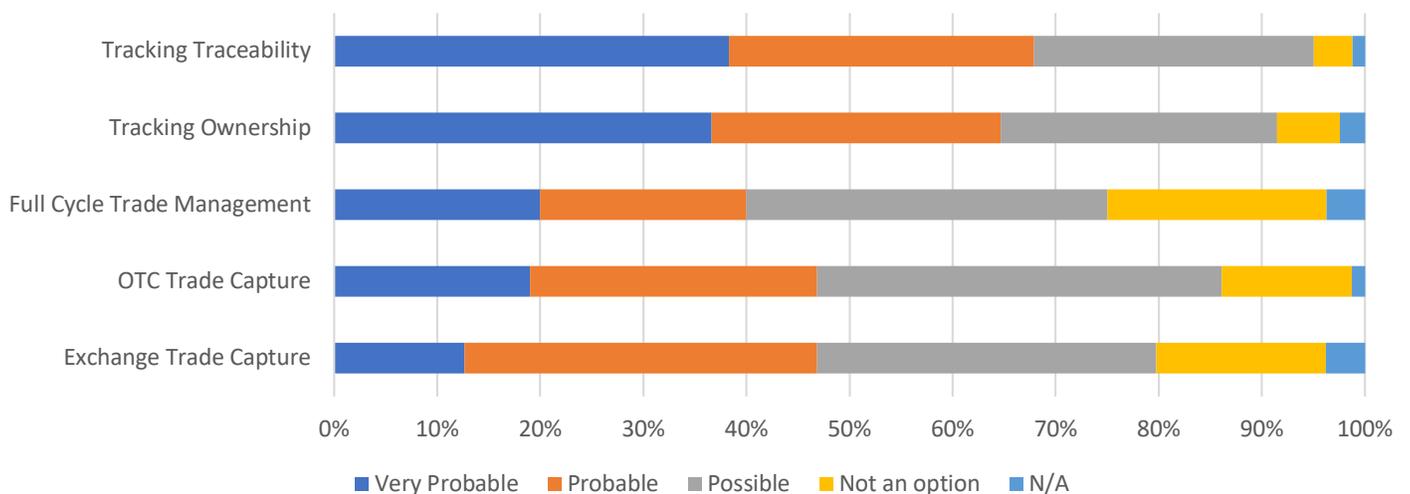
Figure 6: Which Types of Technology Providers are most Likely To be Disrupted?



In all, our respondents see opportunities for blockchain in most of the areas currently being tested via POCs; however, many saw the strongest potential in the areas of traceability and transfer of ownership, where it can be used to create confidence as a trust-

ed technology. In more trade-centric areas of focus there does appear to remain some resistance as a whole host of issues around governance, speed and cost currently remain somewhat unanswered (Figure 7).

Figure 7: Where do you see blockchain as having the most applicability at this point?

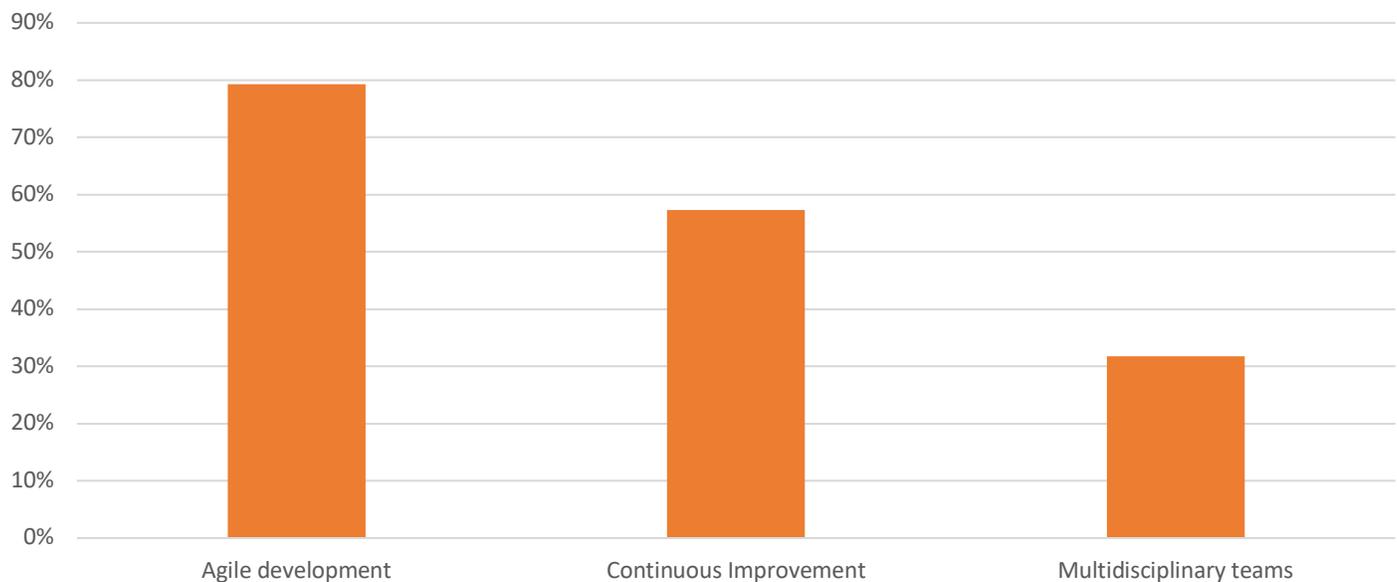


Other Disruptive Technologies

Other disruptive technologies have to some extent been commented on previously, including augmented/virtual reality for data visualization, quantum computing for faster processing, use of drones to capture imagery and so on. Once in production, solutions based on what are currently viewed as disruptive technologies will likely utilize a combination of several of these new technologies...such as ML and AI for management and analyzing big data resources and visualization devices to better make sense of the results.

Finally, looking at how companies may better integrate these technologies into their infrastructures, the survey asked if the respondent's firms were availing themselves of new development methodologies and approaches in an attempt to speed up delivery, reduce risk and adopt new technologies. Around 80% of all respondents are using agile development approaches and almost 60% have adopted continuous improvement techniques. However, only 30% said they were using multi-disciplinary teams (Figure 8).

Figure 8: Are you or your Clients Using Rapid Application Developments Techniques?



SUMMARY

Against the backdrop of massive change and uncertainty, new technologies stand to both disrupt current business processes and industry structures as well as open up new and possibly hitherto unthought-of opportunities in the commodities industry. Plainly, cloud, SaaS and big data are currently having the greatest impact and attracting the most investment...but ML and AI are also important areas of significant interest that are already poised to have huge impacts. Meanwhile, and perhaps reminiscent of the dot com bubble, blockchain is garnering most of the headlines, but appears to be still some way off in terms of delivering the much anticipated, and hyped, benefits.

The survey does suggest that it is areas like data management, Big Data, ML and AI, and data visualization that will see the most immediate deployment and investment (assuming the move to the cloud has already been largely made) in the near-term, with blockchain taking a little more time to mature. None-

theless, based on the sum of our survey, it does seem that blockchain has the potential to be the most disruptive technologies in the future even though, despite a flurry of initial investment in the area, enthusiasm may be slowly dampening for certain use cases such as peer-to-peer trading.

ABOUT FIS

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ABOUT

Commodity Technology Advisory LLC

Commodity Technology Advisory is the leading analyst organization covering the ETRM and CTRM markets. We provide the invaluable insights into the issues and trends affecting the users and providers of the technologies that are crucial for success in the constantly evolving global commodities markets.

Patrick Reames and Gary Vasey head our team, whose combined 60-plus years in the energy and commodities markets, provides depth of understanding of the market and its issues that is unmatched and unrivaled by any analyst group.

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