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SMART SERVICES: DATA–DRIVEN CONSULTING AND THE INDUSTRIAL INTERNET OF THINGS

OVERVIEW

- For heavy industrial companies, the convergence of several long-term technology trends enables unprecedented insight into physical asset and business operations performance:
  - Reduced costs for data generation, storage and compute,
  - Ubiquitous connectivity (even if not yet persistent), and
  - A growing set of sophisticated machine learning and other analytical methods to apply to rapidly proliferating data sets.

- Many industrial companies lack specific expertise to generate meaningful insight from the deluge of potentially available data. For years, such companies have relied upon outside specialists to provide analytics and management support in areas such as reliability, safety, logistics, process optimization, supply chain management, or other industry-specific data interpretation and analysis.

- Such specialist analytical services firms currently generate insights using longstanding software tools and analytical techniques, supplemented by years of human knowledge, understanding, and intuition. They may also maintain massive stores of historical data, often of limited value due to a messy, unstructured nature and disparate data types.

- These data-driven consulting firms may face a threat of disintermediation from emerging software, as decades of industry data is digitized and subjected to machine learning capabilities. They also face the threat of larger generalist firms expanding into their niches through software.

- In the changing data landscape, focused analytics providers will thrive by combining a deep understanding of client needs with expertise in software, data science, and business process management. In many cases it may make sense for such services firms to partner with 3rd parties to integrate this expertise.

- Successful consulting firms will not only satisfy emerging client needs, but find that they have opportunities to selectively reshape their business models, securing both new and more recurrent revenue.

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THE DATA LANDSCAPE IS CHANGING

Leading companies in heavy industries – energy, maritime, utilities, chemicals, and other capital-intensive operations – are reshaping their approach to operating performance improvement in response to the convergence of several long-term technology trends:

- Data storage and processing capacity are effectively unlimited and almost free at the margin
- Sensors continue to decline in cost and physical footprint
- External data sources continue to proliferate
- Sensor, device, and asset-level connectivity continue to improve in quality and cost

This intersection of device connectivity, data storage, and compute capability is often referred to as the Internet of Things (IoT). For industrial companies, the ability to interact with physical equipment has never been greater. Companies now have the ability to access and analyze a previously unimaginable amount of data, arriving almost constantly from a variety of sources, and to make meaningful business decisions from this data continuously.

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Industry leaders are taking advantage of this ability to increase revenue, decrease costs, and to create new business models. However, most companies are just beginning their digital transformation – they typically access, analyze, and make decisions based on just a tiny fraction of the potential data generated from their vassets and equipment.

In the oil & gas industry, for instance, more than 95% of data generated from rig sensors may be lost or discarded rather than informing critical decisions. Combining asset sensors with external sources – such as weather, supplier, or financial data – to make continuous real-time decisions remains a distant goal for many such companies.

Table 1. The Changing Data Landscape for Industrial Businesses

	Legacy system design constraints	Industrial Internet of Things potential system capabilities
Size of datasets generated	Megabytes to gigabytes	Terabytes to petabytes
Timing of data availability	Weekly or daily batches	Near real-time to real-time streaming
Typical analytical approach	Periodic asset-level optimization with linear programming models	Continuous system-wide predictions and optimization with machine learning models
Decision-making integration	Periodic reports; dashboards	Real-time alerts; continuous process feedback

Every industrial company must come to terms with the emerging data landscape created by the Industrial Internet of Things (IIoT).

Already, many asset owners and operators are "sensoring up" their physical operations – even

before finalizing the new business strategies, operating processes, and software tools required to realize value from new digital assets and data streams.

DATA-DRIVEN CONSULTANCIES MUST ADAPT TO THE NEW DATA LANDSCAPE

For years, specialist consulting firms have provided analytical support to industrial operations.

Often, such project work requires deliverables based on (or including) spreadsheet models or macros, or legacy database management system reports. These work products are often static, inflexible, and limited to short-term, one-off insights due to legacy system constraints. Typical project deliverables may not be capable of managing streaming data in large volumes, especially if multiple sources are required; they are often restricted to periodic data snapshots.

Over time, many firms have accumulated a significant amount of such batch data, but have limited ability to assess how such data can meaningfully impact their operations or be monetized in newer, more valuable ways.

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Table 2. The Changing Data Manipulation Landscape for Specialist Consultants in the era of IIoT

	Legacy system design constraints	Industrial the Internet of Things potential system requirements
Depth of analytics skills required	Basic statistical methods on structured batch data	Broad-based combinations of machine learning and physical models applied to streaming time series, structured, and unstructured batch data
Tools	Desktop software such as Excel, Access DB or some form of data mining tools	Python or other data science-friendly software development environments; cloud data storage; cloud data visualization tools
Data cleansing	Manual, often requiring human intervention as part of a frequent consulting exercise	Automated with trained machines, applied repeatedly on massive streaming data sets and unstructured batch data
Modelling needs	Static – one-time insights are adjusted periodically	Dynamic - able to account for on-going changes in the behavior of physical infrastructure

SPECIALTY ANALYTICAL CONSULTANTS ARE UNDER THREAT IN THE ERA OF IIoT

Several large generalist consulting firms have already made significant investments to capitalize on the new data landscape. These firms are acquiring or investing in digital innovation labs and software centers of excellence, building significant data science capabilities, and working with major industrial companies to define new areas in which an expanding analytical toolkit may be applicable. In many cases, these large firms may look to expand into niche applications historically owned by specialist firms, including projects related to reliability, safety, supply chain, logistics, process optimization, and other industry-specific data analysis and interpretation.

In addition, analytical service providers face a growing risk of disruption from new software applications. Previous waves of software for heavy industries displaced or forced adaptation from consultants in areas such as engineering design, process simulation, and seismic interpretation. IIoT applications enable real-time modeling and large-scale data science throughout an industrial network at an unprecedented scale.

Domain experts with relevant industry experience are already working with dat a scientists and software companies to expand capabilities into a variety of niche areas, potentially threatening the experienced consultants who have worked in such areas for decades.

HOW WILL SMALLER CONSULTING FIRMS COMPETE IN THIS NEW ENVIRONMENT?

The critical driver of the new data landscape is the significantly lower — and rapidly decreasing — cost of data acquisition, communication, storage and processing.

Smaller firms are not disadvantaged vis-a-vis other competitors in this respect. However, smaller consulting firms may lack sufficient experience with one or more of the primary ingredients required to provide meaningful value in the new data landscape:

- Software expertise to access and process massive volumes of data, including massive sets of time series data and messy, unstructured historical or external data sources
- Data science expertise in large-scale modeling and machine learning to analyze such massive volumes of data, and
- Internal and client business process understanding to make better, faster decisions from a constant stream of new information.

Without these capabilities, firms will not be able to generate meaningful insights from the deluge of new data, or create client value from such insights as they constantly update. Many consulting firms may view areas such as software development and data science as far outside of their standard knowledge base and skill set. In order to thrive, they may need to integrate strong 3rd party offerings, even as they work to upgrade their internal capabilities.

NEW DIGITAL CAPABILITIES ENABLE SPECIALIST CONSULTANTS TO BETTER SERVE CUSTOMERS AND TO INNOVATE THEIR BUSINESS MODELS.

Data-driven consultants often have a project workflow that involves some or all of the following steps:

1. Acquire a batch of client data
2. Cleanse or structure client data
3. Perform analysis on client data
4. Augment analysis with consultant-owned data sources
5. Augment analysis with 3rd party-provided data sources
6. Synthesize results into a report
7. Present report to client
8. Iterate process based on client feedback

Arundo works with specialty analytical consultants focused on a variety of industrial applications to deliver steps 1-6 above, quickly and accurately, through the Arundo software platform.

This enables the internal methods and experience of consultants to build on cutting-edge data ingestion and pipelining, model deployment and management, and data science expertise. Specialist consultants are now able to access and analyze larger volumes of data more quickly than ever, and provide timely insights to their clients at a lower delivery cost, while maintaining the high-touch relationships that are critical in these situations.

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THESE CAPABILITIES CREATE A FOUNDATION FOR EVEN GREATER VALUE OVER TIME.

This capability also enables consultants to potentially offer more than periodic insights. The ability to ingest and analyze massive amounts of real-time data creates new ways to engage with clients. Consultants can now provide ongoing insights, as well as deeper analysis of select client issues that are surfaced through this work.

In addition, consultants can start to find value in historical data that may exist on laptops, servers, and memory devices throughout their organization. The ability to automatically ingest and analyze historical data – including .pdf and other image files, numerical data, and text documents – creates new business options for specialty consultants.

Now these firms are able to create subscription packages, "made-to-order" reports, and other custom analytics based on proprietary data. This monetization of proprietary data enables new and deeper relationships with core clients in their industry.

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WINNING ANALYTICAL CONSULTANTS WILL COMBINE THEIR DEEP CLIENT RELATIONSHIPS AND PROVEN EXPERTISE WITH DIGITAL SOLUTIONS AND DATA SCIENCE AS QUICKLY AS POSSIBLE.

Since at least the 1980s, successive waves of global forces, new technology, and resulting best practices have permeated heavy industry with varying degrees of rapidity.

The Industrial Internet of Things increases the transparency, auditability, and velocity of business data and decision-making. The resulting wave of digital transformation is already changing how heavy industries behave.

Industrial companies that adapt most quickly to this new environment are likely to significantly lead their slower competitors in a world that may look increasingly like the "winner takes all" landscape of some technolgy-driven markets. Industrial leaders are already investing heavily to create such separation. Firms that provide analytical services to these companies face similar choices: conform to new standards of data-driven insights, or face stiffening headwinds from new competitors.

If you would like to explore opportunities to operationalize and scale data science into your industrial consulting practice, please contact us.

If you would like to explore opportunities to integrate advanced machine learning and large-scale data science software capabilities into your industrial products, please contact us.

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