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### 2ND ANNUAL DATA GOVERNANCE, DATA QUALITY AND ARTIFICIAL INTELLIGENCE IN THE SUPPLY CHAIN

A Study by the Supply Chain Resource Cooperative at North Carolina State University

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### TABLE OF CONTENTS

Executive Summary
Introduction:
Data as a Resource6
State of Data Quality7
Workload Impact Due to Poor Data Quality8
Data Mining Capabilities10
The Future of Data Mining12
Data Analytics and Data Governance Organization 18
Conclusions22

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### Executive Summary

The results of the 2018 Annual Data Governance, Quality and Artificial Intelligence Survey by the SCRC at NC State University, with the support of IBM Watson Supply Chain, provides some important insights for organizations seeking to pursue digital transformation. These results are summarized here across the categories of Process, Technology and Data.

- In general, organizational data governance and data quality seem to be improving, relative to 2017. However, the rate of improvement is still low, and it appears organizations are not meeting the expectations they set themselves for improvement in these areas. As a result, organizations are not gaining the insights and value from their data that is possible to drive improvements/value in the business. Seventy-five percent of businesses say that poor quality data has made it challenging to achieve their digital transformation plans.
- One reason for this may be that spending on analytics training is decreasing and budgets seem to be shrinking, along with lack of application of the right technology and a focus in training and standardization.
- Senior supply chain and procurement management question their organizational capabilities and required skill sets to perform data analytics, yet are hesitant to invest. We believe that organizations may be too focused on short-term outcomes, and are not considering the competitive advantages created by analytical capabilities.
- Only 15% of respondents believe their existing systems are capable of producing clean data that can be trusted. In addition, 20% more respondents in 2018 emphasized that they are spending more than one-quarter of their day searching for data, a significant increase over 2017. Speed in data retrieval involves having good data governance systems that bring critical data to users in a format that is easily accessible.

- Many organizations believe AI can help solve data quality problems but paradoxically cite a lack of data quality as a reason or not investing in leveraging advanced technology.
- Senior executives are taking a pensive "wait and see" attitude towards enabling/advanced technologies that could erode anticipation by their workforce as they prepare for the digital shift. Building an analytics capability requires investment in employees to begin the process of working on proof of concepts, learning through trial and embedding analytics into the business culture.
- The survey data suggests that a larger group of senior management may not be completely aware of the impact of poor data quality on the decision support systems, though a majority perceive that their competitors may be surpassing them in the application of data-based decision-making.
- Time spent in finding information and redoing data analysis is a significant drag on productivity in the knowledge economy and digital transformation. Slow data retrieval is an impediment to the need for realtime data and real-time decision-making.
- More companies are creating Chief Data Officer roles, but there is little agreement on where such individuals should sit in the organization.
- Very few companies have invested in creating a data governance organization in place, although most executives agree that it is needed.
- Ownership of data governance, if the role even exists, appears to be scattered across different business functions and job titles and is generally not systematically connected to the needs of governance.

### Introduction:

The 2018 Annual Data Governance, Quality and Artificial Intelligence Survey is the second in a series of annual efforts led by NC State University to understand the challenges and opportunities that exist for organizations as they navigate the digital transformation era. In this study, we assess the current state of data governance, data quality and advanced analytics in organizations. This iteration of our survey was conducted with the sponsorship of IBM and support from the Chartered Institute of Purchasing & Supply (CIPS), along with the Cognitive Computing Consortium. We have broadened the scope of our survey for 2018 to reflect the market and technological shifts in the scope of the problem as well as the opportunities to improve the state of data and data governance. Our survey reflects these shifts as we continually improve our approach to mapping the depth and complexities involved in creating a foundation for data as the basis for effective supply chain analytics.

Several unexpected insights emerge from this study along with a number of trends that we noted in the last survey. The largest market shift in 2018 was the launch of General Data Protection Regulation (GDPR) in Europe and the general increase in executive management expectations for analytics that dominate much of the conversation. Although these events may not immediately impact the way organizations structure and deploy their data governance initiatives, they play a role in the speed and necessity at which executives are motivated to invest in data governance. As data management maturity improves, we have noted the levels of significant interest on this subject, as reflected by the increased responses to our survey. This year 123 executives from 17 industries across the world responded, spanning organizational revenues well in excess of \$300 B.

Siloed data, lack of standards and lack of skills remain the most significant challenge for improving data governance. These challenges are at the root of poor data quality and suggests that data and analytics roles are being starved of resources needed to fix them. There are some areas of disagreement about the role of data governance within organizations, and where it belongs in the enterprise. A common theme is the increased levels of excitement on the potential for data to shift business priorities, which has reached all corners of the world in our survey (U.S., Europe, South Africa, and Australia). However, some things still remain the same; although there has been a rise in the use of more advanced analytical tools, Microsoft Excel remains unarguably the most commonly used analytics tool in the world!

#### Figure 1 – Presence of data governance organization within respondent industries

Presence of a separate data governance organization (within respondent industries)



As shown in Figure 1, more companies are investing in a separate and distinct data governance organization. Given the importance of data in software, healthcare, and financial services, it is not surprising that these sectors are most heavily invested in establishing a mechanism for ensuring the management and quality of their organizational data.

Businesses around the world are trying to leverage their new caches of data to initiate increased use of data in decision-making across functional lines. At the root of data-based decisions is the need for data governance:

Data governance is a system of decision rights and accountabilities for all informationrelated processes, which describe roles and responsibilities associated with managing the flow of information, data storage, retrieval, and application for intelligence and analytics applications. For organizations to be able to rapidly make decisions based on real-time analytical insights, (including dashboards, notifications, or predictive analytics), data governance is the foundation for building this capability.

We also note that companies have deployed data analytics more frequently within the marketing and advertising functions, and to a lesser extent in the procurement and supply chain disciplines. As a result, there is a significant opportunity for the procurement and supply chain disciplines to invest and seize the competitive advantage derived from improved analytical capabilities.

### Data as a Resource

Data is a critical resource that is the foundation of any company's efforts to achieve a digital transformation. A recent study<sup>1</sup> by Experian found that:

- 75% of businesses say that poor quality data has made it challenging to achieve their digital transformation plans.
- 89% of the businesses say that meeting their digital transformation plans will require a structured data migration.
- 73% of businesses say that they lack the necessary talent to drive their digital transformation plans.
- 92% of businesses believe that high-quality data is the fuel for digital transformation.

The implications are clear: before "digital" transformation can occur there needs to be a "data" transformation. Data comes in many forms and can be classified into two general categories: Structured and unstructured data. Structured data can best be described as data in columns and rows residing in a traditional database and/or spreadsheet format. Unstructured data can be defined as all data that exists in different forms of media, including such diverse media as PowerPoint presentations, e-mails, videos/photos, news releases, articles, and others. In fact, according to a study by ICAEW, more than 80% of all data is considered "dark data."<sup>2</sup> Both structured and unstructured data are growing at an annual rate of about 40% a year.

The vast majority of companies are limited to only mining structured data. This study focuses on structured data as the primary source data used for business decision-making but recognizes that unstructured data will become more important in the future.

1 https://www.edq.com/resources/data-quality-infographics/harnessing-digital-transformation/

2 https://economia.icaew.com/features/may-2018/how-ai-can-untap-the-dark-data-goldmine

### State of Data Quality

As shown in Figure 2, the overall perception of Data Quality within our population of enterprises increased a combined 14% for the Excellent and Good categories when comparing 2018 to 2017 survey results. This suggests that data quality is becoming a bigger priority for senior management, and that increasing resources are being dedicated to improving the value of data as an asset and a resource. Data quality is a function of ensuring policies, rules and procedures for handling data are in place, and that the possibility of errors is minimized through increased control and compliance of data capture and storage into a secure environment. The focus on "digital transformation" begins with a focus on "data quality."

As shown in Figure 3, the overall data quality improvement increased from last year by 9% for the "Significantly Improved" and "Improved" categories. Although the rate of improvement suggests that data quality is getting better, we believe this rate is low as the focus remains on incremental efforts rather than addressing root causes that could result in greater gains in data quality. Organizations serious about moving to a data-driven analytics culture must focus on this foundational element to build the baseline for the analytical shift.



#### Figure 2 – Comparison of Data Quality in 2018 and 2017



#### "2017" Data quality improvement over the previous 2 years



#### "2018" Data quality improvement over the previous 2 years



# Workload Impact Due to Poor Data Quality

The time spent finding information and redoing data analysis is a significant drag on productivity in the knowledge economy and digital transformation. Slow data retrieval is an impediment to the need for real-time data and real-time decision-making and is also a burden on the people who are making these decisions. Wasting time looking for data can cost a company 2.5 hours per day per person for each activity as estimated by IDC.<sup>3</sup> Poor data quality is a function of inadequate governance and technology, which produces data silos and flawed data, and ultimately can lead to costly mistakes and poor business decisions. Productivity is impacted when employees have to spend several hours every day trying to find the data they need for a report or a query to make a simple decision. This "cost of poor quality" can also have a major impact on workload and worker productivity and turnover.

Clean data is a critical factor in establishing confidence for effective data-driven decisionmaking. It has been consistently reported that data analysts typically spend 60% - 80% of their time cleaning and organizing data sets so that it can be used with a level of confidence to produce analytical insights. Organizations in our survey reported that only 15% of respondents believe they have the capability to provide clean data directly from their current systems, suggesting that significant data cleansing is still required for the majority of companies.

With the rapidly increasing volume and velocity of that data companies are receiving and storing they are spending more time looking for relevant and useful data. Our results suggest that organizations are spending more of their time searching for the data they need. In fact, 20% more respondents in 2018 emphasized that they are spending more than 25% of their time looking for data, a significant increase over 2017.



3 http://ftp.qbssoftware.com/public/info/adobe/2012/acrobatxi/ADOBEAcrobatProductivityWhitepaper.pdf



#### Figure 5 - Time Spent Looking for Data in 2018 vs. 2017

2017 - Time spent looking for data

Given that both the volume and velocity of data that can be leveraged to drive analytical decision-making is growing exponentially, a key priority for companies should be to establish a mechanism to create a singular, unified view of "truthful" data. Organizations are seeking to accomplish this through adoption of newer technologies like cloud computing, blockchain or AI, establishment of "data lakes" for analytical purposes, and more frequent migration of data into

these environments from their distributed legacy systems that may be operating in different parts of the business. However, this is easier said than done. In fact, recent research suggests that 74% of businesses note they are using different systems for real-time data and historical data storage and analysis and 95% are facing significant obstacles in creating a unified view of their data. However, 97% say they are investing in analytical systems, although more than half say are in the early stages.<sup>4</sup>

4 http://newvantage.com/wp-content/uploads/2018/01/Big-Data-Executive-Survey-2018-Findings.pdf

### Data Mining Capabilities

A company's ability to mine information and knowledge from its stored data is a function of, 1) the <u>skills of their IT</u> staff and end users 2) access to the data, and 3) the availability and knowledge of <u>tools</u> that can manipulate and produce useful visual representations of the data. This year's survey suggests an interesting trend regarding the analytical skill sets required to be successful in data mining.

The survey results shown in Figure 6 suggest that companies have reduced their investment in data-related training in "2018" vs "2017," even as the demand for analytical outputs and digital transformation has dramatically increased. This is validated by other recent studies that also indicate a downward trend operating budgets for training of the procurement function, and that more than a third of companies are devoting less than 1% of their operating budget to training.<sup>5</sup>

Specifically, the results in Figure 6 suggest that only 29% of firms in our sample are engaged in data-related training for their supply chain personnel, down from 55% in 2017. One possible reason may be that procurement executives believe their staff are already overworked and do not have the time to be trained in new skills. Supply chain executives may also believe that other functions such as IT should be driving their firms' analytics initiatives or that budgets have been cut for training.



#### Figure 6 – Data-related training for 2018 vs. 2017

5 https://www2.deloitte.com/us/en/pages/operations/articles/chief-procurement-officer-survey.html

#### Figure 7 – Analytical Training Topics

In 2018, what sort of training do you plan to provide for your employees related to analytical decision making? (Choose all that apply)



For those firms who are engaged in analytics training for their employees, our results suggest that they intend to focus on functional knowledge, business-oriented knowledge, or training provided by software providers (Figure 7). Other forms of training focus on compliance and data management.

As shown in Figure 8, the primary data mining tool still in use is Excel, (by a considerable margin), followed by Microsoft Power BI and Python. We find that the majority of users are most comfortable using Excel, as it has been in use for more than 20 years at many companies. Some AI tools, such as IBM Watson, can quickly ingest Excel spreadsheets, typically

a time-consuming task, and standardize and utilize the data contained in them.

An increasing number of firms are using Microsoft BI as a visualization tool, as it can also handle large datasets in a cloud-based environment. In addition, more companies are using Python as a statistical analysis tool. The value of Python is that it allows users to essentially "dump" multiple independent variables from multiple data sets into a database and enable regression analysis and other analytical analysis to determine which variables are good predictors. Python also has a large library of tools and has become very popular among college students entering the workforce as the primary tool for analytical insights.



#### Figure 8 – Primary Data Mining Tools

2018 Relative Ranking of Data Mining Tools

2nd Annual Data Governance, Data Quality and Artificial Intelligence in the Supply Chain Page 11

### The Future of Data Mining

Given the extremely large volume and high velocity of data, artificial intelligence (AI) will likely become an important analytical tool to support data-driven decision-making. In our survey, only 23% of the respondents are currently using some type of AI tool for their data analysis. Examples of AI tools include machine-based learning, deep learning, and process automation. There are literally hundreds of different AI tool providers that are focused on different industry verticals, and many are in the very early stages of development. It is important for organizations to be agnostic and to experiment with many different tools to discover which may work best and are aligned with their organizational objectives.

Our survey suggests that the threat of competitors focused on developing analytical approaches is growing. A majority of senior corporate executives perceive that their competitors may be surpassing them in the application of data-based decision-making. This perception has grown from 47% in 2017 to 80% in 2018. Despite this perception that the competition is forging ahead, only 23% of executives in our sample are moving ahead with efforts using AI with their data (Figure 9). To move forward, small steps involving proof of concepts with AI should be adopted by teams of functional leaders. Such efforts do not have to start with or always involve significant investments, and could be exploring the use of tools such as Microsoft BI and Visio, while starting to adopt advanced analytics solutions. This will help provide insights into the viability of newer methods that involve non-traditional approaches including the deployment of AI. Such efforts can also leverage local university student projects and internships to engage students in exploring datasets using the new tools for analytical improvement, as well as engines such as IBM Watson and others. For instance, students at North Carolina State University have leveraged public news feeds to develop indicators of supply maturity that has been used in benchmarking performance.



Fifty percent (50%) of the survey respondents believe that it will be at least 5 – 10 years before AI is ready for applications in the supply chain (Figure 10). Given the rapid deployment of AI in other business functions, this statistic is surprising and suggests that supply chain executives may be hesitant to explore proof of concept pilots using advanced technologies such as AI. Again, it is imperative for leaders to begin exploring such applications through pilot projects focused on high impact business problems, to create and learn from proof of concepts. In this manner, learning will ultimately occur through trials and learning what works and what doesn't. Organizations that move quickly by "learning through doing" will be ahead of the curve in the application of these technologies.



#### Figure 10– Readiness for AI Application

Despite some hesitancy to immediately explore the use of AI (50% of the respondents), an approximately equal number (49%) are already using AI, evaluating it or reviewing it (see Figure 13). It is interesting to note that more than two-thirds of respondents have high hopes for AI's potential in helping organizations with data quality issues (see Figure 12). Further, respondents report that they have had success with initial forays into emerging technologies – such as IoT, Machine Learning, blockchain, natural language processing, and robotics – many of which complement or form the basis of AI (see Figure 11).



Figure 11 – Importance of Emerging Technologies

#### Figure 12 – Expectations of AI



Do you consider AI and/or Machine-based -learning as a means to help the data quality problems you face in your organization?

#### Figure 13 – Use of AI Technologies

Where does your organization stand today with using Artificial Intelligence (AI) technologies as part of the supply chain function's suite of analytical tools?



#### Figure 14 – Data Quality as a Barrier to AI



Do you consider data quality as a major hindrance to adopt AI solutions?

Additional support for this statement can be found in the result shown in Figure 14 that data quality remains a major barrier to implementing and realizing success from AI. This "chicken and egg" scenario provokes us to consider the following: AI cannot be implemented without good data quality, but AI can be used to help improve data quality! AI can help address data quality by, among other methods, assisting with data capture, expediting data standardization, eliminating duplicate records, providing anomaly detection and by understanding and comparing unstructured data. Data quality is not the only attribute required to gain user acceptance. Our 2018 study results shown below identify the other major attributes of data that must be satisfied to gain user acceptance. In general, data accuracy and consistency top the list of attributes that are important. It is interesting that in the food and beverage industry, completeness of data is the most important attribute (See Figure 15). It is critical for organizations to establish metrics for data quality and be clear about the priorities for ensuring that these attributes are emphasized in their operational data governance approach. Figure 16 shows that the most common excuse for not improving data quality is that it does not have a good ROI, that it is not a consistent problem, and that it is a technology issue, not a people issue. These excuses are in fact myths. Data quality is imperative if organizations are truly committed to moving forward with the digital transformation.

#### Figure 15 – Data Quality importance by Industry



Data Quality practices and ratings within specific industries participating in the survey

#### Figure 16 – Reasons for Lack of Data Quality

Reasons for lack of data quality



### Data Analytics and Data Governance Organization

As shown in Figure 17 below, organizations recognize that a formal data analytics organization is needed, but only a minority of companies (24%) acknowledge the existence of such an organization. Few supply chain organizations have a devoted data analytics organization.

#### Figure 17 – Data Analytics Organization

Reasons for lack of data quality



#### Figure 18 – Governance Tasks by Job Title

The perceived governance tasks performed by job title



To build an effective data governance effort, it is critical to ensure the right level of executive oversight. Ideally, senior executives should champion a data governance organization to promote and establish the right level of emphasis and support across the organization. Our results shown in Figure 18 suggest that a variety of different roles and responsibilities exist, and that a lack of clarity around these roles may impede progress in data governance efforts.

#### Figure 19 – Steering Committees for Data Governance



"2018" Composition of the data governance steering committee by industry

The survey shows that procurement organizations have an involvement in the data governance steering committees of every industry surveyed with their strongest involvement in the hospitality/travel industry, government and education (Figure 19). IT and Finance are generally leading the efforts in a majority of circumstances. Having IT lead a data governance effort may not be the best solution. Many organizations recognize that data governance is the responsibility of every function and that responsibility for one's own data quality is critical if a function wishes to engage in a central analytics transformation.

#### Figure 20 – Creating a Unique Data Analytics Organization

Steps Taken To Utilize Data



An important step that signifies a serious effort to improve data and engage in the digital transformation is the appointment of a Chief Data Officer (CDO) for the enterprise. One of the primary tasks of this individual is to initiate an enterprise-wide data governance process. The creation of the CDO position is also a visible sign of senior management's recognition of the need for data quality. This individual will need to be prepared to deal with significant change management issues, as individuals in the past have tended to "hoard" their data resources and have not always been willing to share data with others in the organization. A unified approach to enterprise-data access is important to drive analytical insights that lead to better decision-making. The steps deemed to be most important are shown in Figure 20 and involve a dedicated organization. IT departments should be focused on hardware and structural issues, whereas data analytics requires a different set of skills and capabilities.

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### Conclusions

The results of our survey have a number of important insights for deployment of the digital transformation beginning with establishing a data governance organization. These results are summarized here across the categories of People, Process, Technology and Data.

#### People

- Training of subject matter experts and data analysts to work collaboratively to apply analytical tools is needed. Unfortunately, spending on analytics training is decreasing.
- Senior management and CPO's question their organizations' capabilities and skill sets to perform data analytics and engage in AI projects.
- Companies are beginning to create and staff the title of Chief Data Officer, but there is little agreement on where this individual should sit in the organization, and considerable variance in how the function is organized.

#### Process

- There are very few companies with an existing data governance organization in place, although most organizations agree that one is sorely needed.
- The current ownership of data governance, if it exists, is scattered across a number of different business functions and job titles, and appears to be assigned in an ad hoc manner.
- Processes for tackling business issues using AI technologies are not yet well defined and documented. This may be attributable to the lack of a centralized analytics center of excellence tasked with engaging in such projects.

#### Technology

• The supply chain and procurement functions are not adequately deploying and/or leveraging advanced technology, particularly AI to improve data quality and insights. A lack of understanding of AI and related technologies may be hindering learning and exploration.

- Ironically, organizations believe AI can help solve data quality problems, but also believe that the lack of data quality will prevent AI from being adopted in the near term.
- Senior management's expectation as to when their organizations will be able to benefit from advanced technology is as far out as five years or more. This reflects a "wait and see" attitude that may be dangerous, as organizations also believe competitors are moving ahead. Building an analytics capability requires investment, trial and error, and proof of concepts, and requires a paradigm shift and cultural alignment around development of this capability.
- Senior management and CPO's question their organizations' capabilities and required skill sets to perform data analytics, yet are hesitant to move forward. Too often, supply chain and procurement are focused on year-over-year cost savings, and are not looking forward to the opportunities created by analytical capabilities.

#### Data

- Data Quality remains a significant impediment to obtaining value from data.
- Signal to Noise Ratio (SNR) in data remains unmeasured and largely unadopted as a tool for data quality improvement.
- Significant resources are being deployed to gather, maintain and secure data as it is increasingly viewed as an asset.
- There remains a gap between the expectations and reality in realizing value from data.

Companies large and small in practically every industry fear the innovation and disruption that they might confront due to the digitization within their industries. Data, a critical component in any digital transformation needs to be viewed as a critical asset. An asset-centric approach to data is a proactive approach which leads to a greater visibility and protection of all assets. Procurement and supply chain functions are lagging in the creation of data governance and quality initiatives resulting in a low adoption rate of AI. In order for AI to be successful it needs unified data (limited data silos) and consistent, high-quality, complete, timely and relevant data.

While senior executives appear to be committed to creating a digital environment and creating a data-driven culture, it is proving to be a challenge.

The supply chain and procurement organizations in most companies are not investing in digital capabilities that will pioneer the digital transformation. As the world moves to a digital economy that produces vast amounts of data, procurement organizations are slow to even explore, let alone adopt one of these technologies. Organizations are encouraged to partner with universities, providing access to young people who are not afraid to dive in with these new digital technologies accessing large pools of data, and to "learn by doing."

Despite this sobering news, some progress has occurred between 2017 and 2018, as organizations are more aware of how data can change their business. The opportunities to be derived from quality data and data governance are significant and have yet to be realized by most procurement organizations.

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#### **Title of Respondents**

- Analyst
- Consultant
- CPO/CSCO (Chief Supply Chain Officer)
- Director/VP
- Manager/Sr Manager
- Other

#### 2018 - Spend in USD



#### 2018 - Revenue in USD



## Addendum to 2nd Annual Data Governance, Data Quality and Artificial Intelligence in the Supply Chain

A Study by the Supply Chain Resource Cooperative at North Carolina State University and IBM

The annual data governance, quality and AI in supply chain survey by SCRC presents a unique opportunity to understand the maturity, utility and usability of data-driven decision-making in supply chain. While the study presents some concrete findings indicating the state and direction of the data usage practice, it also poses a lot more questions on the future state and related behavior. This short addendum to the full report presents some directional inferences that we believe could be of interest to leaders and practitioners. These results are inferences based on empirical evidence and cross-references provided by further analysis of the survey, but have not been rigorously empirically tested.

The data suggests that most of the adoption of AI is being driven by early adopters; and that the vast majority of practitioners across various industries are taking a "wait and see" approach regarding adoption of AI or other emerging technologies in supply chain. While there exist great examples for significant adopters of these technologies in all industries, in our survey the industries most actively considering applying AI are the Consulting, Media/Entertainment/Publishing, and Telecommunications.

Currently, the most prevalent areas where AI is actively deployed/prototyped are in applications such as Fraud Detection; Optimization and Forecasting. However, the areas being most actively considered for upcoming application of AI are Risk Management, Compliance and Optimization.

Across the whole spectrum of technologies considered, Machine Learning, Natural Language Processing (NLP) and Process Automation are reported as the most relevant capabilities. (biggest areas of consideration). Our qualitative evidence suggests a lot of activities in the industry are driven by partnerships with universities, industry consortiums etc., which offer some form standardization and reduced risk while enabling accelerated outcomes.



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Manu factu rin g

Retail/Wholesale Distribution



Energy/Oil & Gas Utilities

2nd Annual Data Governance. Data Quality and Artificial Intelligence in the Supply Chain

E duca tio n

Page 23

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Dr. Handfield is the author of several books on supply chain management, the most recent being Biopharmaceutical Supply Chains, Supply Market Intelligence, Supply Chain Re-Design and Introduction to Supply Chain Management (Prentice Hall, 1999, 25,000 copies sold, and translated into Chinese, Japanese, and Korean). He has co-authored textbooks for MBA and undergraduate classes including Purchasing and Supply Chain Management 6th revision (with Robert Monczka) and Operations and Supply Chain Management 3rd revision (with Cecil Bozarth). He recently led a global study on the Emerging Procurement Technology: Data Analytics and Cognitive Analytics for CAPS Research, Procurement Analytics for IBM, Global Logistics Trends and Strategies for BVL International in 2013, and a report entitled Future Buy: The Future of Procurement published by KPMG.

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