Artificial Intelligence and its impact on procurement and supply chain

A comprehensive study
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I. INTRODUCTION: ARTIFICIAL INTELLIGENCE WILL BE A KEY CORNERSTONE FOR DIGITAL PROCUREMENT AND SUPPLY CHAIN

Within a highly competitive field of profound technology innovations, Artificial Intelligence (AI) is clearly at the head of the pack. It’s frequently recognized as the technological forerunner when it comes to revolutionary levels of enablement. Its potential power and influence is far reaching across verticals and functions. From finance to pharmaceuticals, logistics fleets to CRM – AI is impacting almost every layer of the modern organization.

This has not gone unnoticed by lines of business leading from the operations floor right up to the C-suite, which is increasingly acknowledging the magnitude of opportunity surrounding AI, as well as the processes, platforms and risks that underlie it.

Procurement and supply chains, along with the wealth of data they generate, are both ripe to leverage the efficiencies and insights afforded by AI, and in some cases already are. However, the level of ambition, capabilities and change required to get the most from the technology can appear challenging.

Through this paper, we intend to break down some of the essential AI concepts and showcase the game-changing applications that we believe are most relevant in procurement and the supply chain. We have engaged leaders across procurement and technology from a range of sectors, as well as experts who are developing the implementation tools enabled by AI, to present an overview of where this technology could lead sourcing and logistics.
A. Evolution of Procurement and Supply Chain Through the Digital Era

Technology has been both the catalyst and enabler for procurement to progress from a transactional, pen-and-paper-driven function of the 1980s to the digital, strategic business partner that we see today (Figure 1). The transformation has coincided with tectonic shifts in the technologies and tools that facilitate successful procurement performance. The first truly seismic change came from the mid-2000s onward, when eProcurement and eSourcing became more fully established. By the mid-2010s, predictive analytics was being coupled with these tools to give rise to what is now recognized as “Digital Procurement.” Since then, the rate of change has been astonishing, and this continues to progress with the simultaneous advancements in other transformative technologies: AI, robotic process automation (RPA), blockchain, and the Internet of Things (IoT), to name a few. Clearly, procurement’s directive is to embrace such technology, define a clear strategy for implementation, and reimagine perceptions of the procurement landscape. Implementation of these transformative technologies and leveraging them to address long-term challenges related to sourcing is what is meant by Digital Procurement.

Supply chain potentially has an even greater expectation to act upon the opportunity for becoming a digital function. If optimized, supply management enables the business to better meet demand requirements and deliver distribution to match, with a minimal gap between the two. Therefore, improving the supply chain’s success can drastically impact the customer experience and, potentially, revenues — especially with the increasing conversations surrounding Industry 4.0, the
widely publicized next step in the supply chain digital evolution (Figure 2). This is defined as the fourth industrial revolution following automation — firstly through steam and water, followed by electrification, and the introduction of computing from the 1970s. This encapsulates the digital transformation that will touch virtually all aspects of a business, advancing everything from R&D to manufacturing to sales and marketing to operations, removing the silos that exist along the moving components of a typical supply chain. The traditional operating model will evolve to a highly connected, intelligent and optimized supply ecosystem. The key technologies that are the catalyst for the transformation in procurement will be the same driving forces for supply chain.

B. Changing Expectations in Meeting the Digital Imperative

With most areas of the business being impacted by transformation, and with its potential to offer more as an internal function as a result of digitization, the expectations for and from procurement are changing.

With procurement’s mandate transforming from purely “transactional” to “strategic,” the function has undergone a radical shift. The focus has moved from tactical KRAs — making cost-effective purchases while partnering with low-risk suppliers — to highly strategic ones: providing high value-add through high spend visibility, real-time analytics and intelligence; reduction of tail-end spending; and continuously improving on savings targets while lowering cost-to-serve. Digital levers, when pressed in the right manner, promise to positively impact every result area of focus.
for procurement. It has almost become unfeasible for source-to-pay technology tools to enable procurement to deliver on the inflated expectations and new-age KPIs. This has paved way for emerging technologies — automation, blockchain, and to a certain extent IoT — to take center stage. Given the maturity and the success stories that automation technologies have been able to garner, they are expected to lay the foundation for procurement’s foray into the digital realm:

• **Address 100% spend globally**
  A globalized approach that effectively addresses all types of spend — from large recurring to small one-time purchases — across all business areas with the right strategies and expertise for each supply market.

• **Apply real-time market intelligence and analytics**
  Global teams of dedicated category specialists bring real-time market intelligence and a deep understanding of stakeholder needs, provider alternatives and market dynamics to help inform spending strategy and create informational advantage.

• **Continuously deliver savings**
  Compliance is actively driven and savings tracked. Item-level spend data is reconciled against negotiated terms and verified by finance. Experts leverage performance data to drive continuous cost innovation and supplier performance improvements to deliver sustained results.

• **Enable agility and mitigate risk**
  Adapt to quickly respond to constantly changing supply markets and are prepared to mitigate disruptions.

• **Fuel growth**
  Drive savings and supplier innovation to promote growth. Actively deliver synergies and enable global expansion.

• **Support sustainability**
  Deploy dedicated expertise and specialized tools to help manage consumption, reduce environmental impact and waste, and meet supplier diversity goals while optimizing budgets.
Most procurement organizations have thus far focused on the ‘core 5’ transformation levers; however, in the last three to five years, the massive potential of service delivery automation has been demonstrated (Figure 3).

C. The Digital Agenda and Rate of Adoption

Certain technologies are expected to have a greater impact than others. AI and RPA are highlighted as two of the most important, along with others such as blockchain and IoT. With so many different phrases and concepts, it can be hard to get a handle on what the key differences are and how to determine where they would have the best impact. We endeavor here to scope out these ideas and remove some of the confusion surrounding intelligent technologies.

Our survey of leadership across large enterprise organizations outlines a set of key emerging technologies that will facilitate procurement’s entrance into the realm of ‘Digital’ (Figure 4). Automation has clearly emerged as a critical enabler of improving efficiency and driving key business results while abating effort and the cost of manual and repetitive tasks. This means that elements of automation that are most accessible have led the charge in adoption, such as the less advanced RPA and cognitive analytics tools. AI, as a more complex concept, is expected to attain about half the adoption rates for digital initiatives in procurement in the next few years, though with increasing industry understanding, this is of course expected to grow.
Of the $2.1 billion of spend on AI in global services, $250 million was on S2P-related processes. The rate of adoption has not been consistent across all industries, with High Tech/Telecom, Manufacturing and Financial Services being the front-runners. AI will work in tandem with RPA to deliver on automation, the major difference being that AI would apply to unstructured scenarios which demand cognitive capabilities. Common applications thus far have been in supplier compliance and supply chain risk, conversational automated help desks, elevation of knowledge and insights of the management team, and enhanced forecasting and analytical capabilities — all of which will be explored throughout this paper.
II. INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND ITS RELATED TECHNOLOGIES

AI is the technology buzzword du jour, and many publications such as this one are touting its benefits. But what does it actually mean?

There are many different techniques that qualify as AI, so it’s better to view it as an umbrella term that refers to technologies that enable machines to start to think intelligently, even like humans. Here we introduce some of the key concepts that are often used in conjunction with AI.

A. Big Data and Predictive Analytics

Businesses today have many different channels for data collection across all sectors of the organization, from both internal and external sources and in many different formats. The resulting volume of data is large enough for it to be known as “Big Data.” If used correctly, this data can unlock insights that enable improved decision-making and more strategic activities as a result. There are, of course, challenges in doing so. The data can be hugely variable in its speed of delivery, structure and flow, with volumes fluctuating hourly to seasonally. It is also hugely complex, coming from many sources; consolidating, cleansing and finding patterns requires resource. This is where predictive analytics comes in — to make sense of it all. The phrase “predictive analytics” captures different technologies and statistical techniques that recognize patterns, such as in spend behavior or inventory optimization, in the data to suggest predictions, with the ability to determine what data is important. By analyzing past and current data, the algorithms built into the software can identify trends which can be used to support forecasting the likelihood of repetition of a given scenario — similar to predicting weather based on many factors.

B. Artificial Intelligence

AI refers to the collection of technologies — including hardware and software applications, such as machine learning (ML) and natural language processing (NLP) — that are capable of behaving “intelligently.” By this we mean that the machine can conduct functionalities akin to the human brain, such as sensing, comprehension, acting independently and creatively, retrieving information and learning. You often hear the phrases “predictive analytics” and “AI” in the same breath, so what is the difference between the two? In both, algorithms are used to make sense of large
volumes of data and recognize the relationships that lie within. However, predictive analytics is limited to just a forecast or cleansing process of a batch of data; a procurement-focused example might be spend classification.

AI refers to technologies that deploy a constant learning process — cyclic, all-encompassing, and most essentially cognitive. It’s the ability of the machine to teach itself from previous learnings. For example, recognition of attributes in the data enables the deeper discovery of insights from data of which predictive analytics is not capable. This is the main differentiator between AI and conventional programming; the latter is typified by a standard set of instructions. AI-powered technology can teach itself the rules, learning for itself without the need for pre-programming.

The concept is not new — in fact, a rudimentary form of rule-based programs demonstrating some cognitive capability has been available since the 1950s. What makes modern AI different? Most real-world problems are far too complex to be solved by a system following a set of rules defined by people. Additionally, there is now more data and processing power available than ever before. The newer developments allow for the hugely capable machine to learn for itself from experience, from a wealth of data, independent from any set rules. This technique is known as machine learning, one of several terms that fall under the umbrella term of AI. Here we explore this, along with RPA and NLP, as three of the key AI-based technologies that are increasing their impact on organizations and their business functions.

I. Machine Learning

As mentioned, modern AI, sometimes referred to as machine learning, differs from the basic, traditional AI that has been around for many years in that it is not simply rules-based.

Simplistically, machine learning is the use of algorithms to look for patterns, trends and anomalies in data, the quality and accuracy of which improves with experience of the system. The program that the algorithms are built into is able to identify connections in data, but in the initial stages of training doesn’t always identify them correctly. So in the development of the algorithm, we can indicate to it what is incorrect, and it will learn from this and not repeat the same mistake. The resulting fully-developed algorithm has been 90% taught by the time it reaches the customer, and can continue to learn in the end-user organization, adapting to the norms of the new environment and data.
There are more than 15 types of machine learning, and different ones are appropriate for different scenarios. Examples include:

- General adversarial networks – two competing networks: one is creating something, and the other tries to differentiate what is real and fake. Competition makes the two better.

- Inferencing – work out the correct category alignment for a single data point. For example, not every scatter diagram produces an obvious linear correlation. Sometimes the data must be mathematically transformed to see the true patterns and clusters before the line is apparent. Once this transformation has been identified, any new data can also be processed and easily classified.

To date, applications of machine learning to data classification have been the largest areas to be developed and understood. But a Bayesian approach — updating the probability as more evidence becomes available — may not be sufficiently creative or adaptable when there are more variables than in a straightforward problem. However, machine learning is well suited to absorbing large volumes of data and extracting something meaningful from them, such as known quantities and a pathway from A to B.

II. Robotic Process Automation and Smart Automation

As mentioned earlier, automation has clearly emerged as a leading enabler of improved efficiency and driver of key business results while reducing required effort and cost of manual and repetitive tasks. Most organizations are increasingly using the terms “intelligent automation” or “smart automation” which combine RPA and AI technologies. Like other concepts in this area, it is not always obvious how to differentiate them.

RPA encompasses software that replicates human activity, providing easy, rule-based processing developed by business users. It takes routine, repetitive tasks and allows a machine to conduct them quickly, accurately and tirelessly. This leaves people to focus on tasks that require more human attributes such as emotional intelligence, judgment, reasoning and customer/supplier interaction. This is also the key difference of RPA versus cognitively intelligent machines. The latter have the ability to learn these human attributes and automate them, as with natural language processing or providing insights. RPA is better suited to simpler tasks involving rules
and instructions. The benefits of the slightly less complex avatar of automation, such as RPA, are a reality in the present-day context and adoption is relatively high.

This also makes RPA technologies better suited to different applications than more advanced AI applications, and it’s important to understand the specific impact areas of the two technologies to ensure the most benefit is gained. RPA is useful for the automation of repetitive manual effort, such as downstream P2P processes — data entry, payment issue — or in supply chain: management enhancement, asset monitoring, and inventory level optimization. Whereas AI, in performing the tasks that normally require human intelligence, is better suited to more upstream processes such as contract or supplier management, production optimization, or predictive maintenance in the supply chain. While AI’s maturity and adoption in procurement currently lags RPA, a study by The Hackett Group estimates that future adoption growth rates will exceed 240% over the next two to three years.

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<th>RPA</th>
<th>AI</th>
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<tr>
<td>• Helpful in overcoming process and system limitations</td>
<td>• Able to work with existing system limitations to produce relevant output</td>
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<tr>
<td>• Rule-based system</td>
<td>• Behavior adapts over time without regular programming interference, by learning from data</td>
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<tr>
<td>• Mimics user’s activities to automate a process</td>
<td>• Mimics human thought processes using vision, language and pattern detection</td>
</tr>
<tr>
<td>• Able to process data in a structured or semi-structured format</td>
<td>• Can process data whether structured or not</td>
</tr>
<tr>
<td>• Deterministic – no randomness involved in development of system, same output each time from same inputs</td>
<td>• Probabilistic – able to adapt based on probability and understanding uncertainty</td>
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The ability of automation to produce high-impact results across key measurables that matter for businesses — profitability, agility and driving positive customer experiences — is undeniable. “Smart automation” initiatives, combining both AI and RPA capabilities, will improve decision-making and enhance productivity and cost savings. Traditional technology suites are facing incremental challenges to deliver upon procurement’s more recent expectations, making smart automation a priority. Encouraging results from early implementations of automation solutions are expected to move the needle from boardroom chatter to actual adoption (Figure 5).

### III. Natural Language Processing

NLP is an application of AI that allows computers to understand and synthesize raw human language using linguistics and algorithms to change or extract meaning from the text. Just as our brains have learned to structure language, NLP systems can simulate this activity and are able to analyze and manipulate language. By breaking down the text into simpler chunks, interactions between these chunks and their meaning are identified, thereby extracting more value from the text.

This enables more basic functionality, such as translation, as well as much more advanced techniques, such as generating document synopses (helpful in summarizing a large body of text), conversion of speech to text and vice versa, or categorizing the content of a document.
The subtlest techniques can identify mood and meaning. Sentiment analysis picks out the subjective opinions in a body of text to determine the overall sentiment, as well as any outliers in opinion. Alternatively, NLP can be used to detect the key themes across a range of text and apply analytical techniques based on the topic patterns found. An invaluable, recently-emerged application has been in the analysis of contracts, with NLP functionality being able to review documents — a concept we discuss further later in the paper.

Examples are increasingly being seen around the home, or in our mobile devices, in the form of Siri, Alexa and Cortana. Chatbots, a software tool that can have a dialogue online with a person, can be deployed across internal and external customer service, for interaction with suppliers and buyers, and for the actioning of straightforward process tasks.

Technologies such as NLP and machine learning, which are enablers for AI, have only begun gaining prominence and attracting use cases in the procurement context. While productivity and efficiency gains are important outcomes, it is the strategic value-add that AI provides through enhanced insights, identifying new savings opportunities, enhancing spend under management, and automating decision enablement that sets AI initiatives apart from RPA. Early implementations have yielded encouraging results (Figure 6).

C. More Advanced Concepts in the Sphere of Artificial Intelligence
As a growing area of scientific and technological exploration, AI has given rise to a number of other terms which are likely to come up in relevant discussions, including Deep Learning and Neural Networks. These concepts are helping to push AI toward its current apex of development. The crossover with procurement and supply chain applications is more limited at this stage, but helpful to be aware of nonetheless.

I. Deep Learning

The game of Go, a 2,500-year-old Chinese board game, in which two players aim to surround more territory than their opponent, has fairly simple rules. However, the number of potential moves is far greater than even the number of atoms in the universe, making it a highly strategic, complex challenge. In March 2016, Google's Deep Mind AI platform beat the world's top (human) Go player.

The type of AI used in this instance was Deep Learning, in which the algorithms are so powerful they enable cognitive functionality such as speech and image recognition and natural language processing. They use numerous interlinked computing layers, each taking the inputs from the previous layer to build a much stronger pattern recognition ability.

The excitement around Deep Learning has grown in light of the convergence of development of cloud-enabled neural networks, machine learning advancements and the huge data sets made available from the internet. The ability to determine the correct action given context and judgement is now possible using the machine, enabling insights identified within the procurement or supply chain database to be acted upon seamlessly.

II. Neural Networks

Neural networks are highly sophisticated information processing systems capable of modeling extremely complex relationships. The name comes from the structure being modeled on how the brain processes information. This structure is made up of a highly interconnected layer system that process inputs simultaneously to solve a problem. This multidimensional processing power means that the systems are agile, so they can work through huge data sets to derive an understanding of the underlying trends incredibly quickly.
Their power lies in their ability to handle nonlinear relationships in data, which is increasingly common in the ever-growing “Big Data” set. This gives them an incredible capability to glean meaning from highly complex or incomplete data, identifying patterns that would be missed by other computer programs, and even people.

III. RELEVANCE OF AI FOR PROCUREMENT AND SUPPLY CHAIN

Most organizations possess disparate data obtained from multiple enterprise-wide systems. Procurement gathers data on clients, spend, transactions, pricing, suppliers, and contracts from RFPs, POs, spend reviews, contract management, e-catalogues, SRM systems, and expense reports, among others. Similarly, every stage of the supply chain has incoming and outgoing data that affects the entire product journey, from upstream inventory planning to downstream demand management.

However, it is not just data originating within the organization itself that impacts these two areas. External sources, especially in such a highly connected working and operational environment, can provide information that can be invaluable in pursuit of more efficient and strategic management.

On top of the challenge of volume, the following issues will also be distinctly familiar to sourcing and operations professionals:

- **Quality of data**
  - Manual data input in purchasing cycle can lead to inaccuracies
  - General Ledger coding, classification and item descriptions can all vary across the data

- **High-level categories**
  - Uncategorized spend at granular level
  - Potentially defined with more focus on finance objectives, which can be suboptimal to the purchasing process
  - Misclassified data due to lack of low-level detail required
  - Resulting reports are not entirely accurate and can result in less than 100% trust in the quality of output
• Data sources and resulting volumes
  - Multiple ERPs (disconnected systems and IT support dependence)
  - Multiple supplier and spend data sources and master data
  - Challenge to consolidation
  - Consequent data set can be huge — confounding accurate, comprehensive analysis

• Large time and resource investments are needed to resolve the above

It’s understandable for a business to be overwhelmed by the apparent challenge in getting a handle on its Big Data.

Why should procurement and operations leaders be interested in overcoming this challenge and exploring the possibilities AI offers (Figure 7)? The level of sophistication and the resources needed to merge all this data manually is huge, and creating the necessary platform of data is just the first step. This is the beauty of AI — the data is consolidated automatically, making the variables of volume, transience, departments, sources and systems more manageable. And better yet, the insights can now be extracted — by a machine that can identify the trends and patterns, which are not always obvious, at high speeds, in real-time, and can become increasingly intelligent over time. Moreover, the insights are delivered to the relevant team members for the crucial value-added decision-making, or in some incidences this can be left to the machine itself. This can be broken down into tangible result improvements in quantifiable measures such as productivity, turn-around or average-handling time, sourcing cycle length, supply chain planning, and process optimization.

Of course, faster, more accurate and automated data consolidation, analysis visibility and value extraction are not the only beneficial takeaways from AI. Procurement can be perceived as being an obstacle to driving value within an organization. Seizing the moment with transformative technologies that can help make the most of data is a chance for procurement to show conclusively the value-add and ROI it can generate. It can also be a springboard to encourage such progressive strategies within a business. Procurement and supply chain may not always be thought of as leading the technology charge — frankly, supply chain can be portrayed as reactive, and procurement as “back office” rather than strategic. However, demonstrating to the business the operational efficiencies and revenue benefits that they can deliver, can transform perceptions and in turn empower the rest of the business to invest more in these technologies. This can recast
the organization’s internal image as being ahead of the curve, while highlighting the value that sourcing and supply insights can create.

Next, we will review some of the specific areas across the procurement and supply chain pathways where AI can have the biggest impact.

**IV. PROCUREMENT**

**A. Enhancing the Strategy of Sourcing**

Here we focus on specific examples of the potential of AI to extract the abundant knowledge from the wealth of Big Data and automate processes to improve value creation.

We have already looked at some elements of how AI can support analytics, but there is good reason for it to be deployed across the entirety of the S2C analytical cycle, depending on where a business could use it most and increase the efficacy of the strategic sourcing process. The following summary of benefits can be used to transform each stage of the S2C pathway (Figure 8):

- **Category Taxonomy Design:**
  - Improving the structure and standardizing the nomenclature of categorization
• Data Visibility:
  - Automating consolidation, cleansing and categorization of data
  - Identifying patterns within the spend data to unlock insights in cost opportunities and decrease spend
  - Enhancing supplier, category and geographical knowledge with category teams who are better empowered in the decision-making process
  - Deeper market intelligence from a wider range of sources
  - Dramatically advanced supplier risk management with improved visibility of industry news and other untapped resources

• Spend Categorization and Management:
  - Disparate sources with different naming methodologies are aligned to the correct category (see above)
  - Improved ability to leverage the economies of scale
  - Elevated spend analytics and insight capability

• Real-time, Automated Analytics:
  - Processing new incoming data on a weekly, daily or even hourly basis
  - Identifying the key themes, anomalies and trends
  - Extracting the value and recommending the potential best course of action for the given situation
  - Enabling procurement managers to take faster action on more tasks expected to have a positive impact on process and savings

• Opportunity Assessment:
  - Spend, demand, market and cost-component analytics conducted before, during and after key events (for example, a sourcing event) to better evaluate opportunities
  - Faster and more targeted sourcing

• Accurate Report Generation:
  - Auto-generated reporting in different formats, including dashboards
  - Customized, data-driven communications to leadership and the wider team
• Contract Administration, Management and Drafting:
  - NLP techniques to review contracts in depth and at speed
  - Tagging of terms for contract drafting and notification of key dates and clauses
  - Flagging of noncompliance by both parties to mitigate risk and ensure adherence

Not only are there a wide number of applications; different levels exist depending on how advanced the analysis needs to be and what the desired outcome is. The extent of exploitation and value-add that can be leveraged from AI can be represented as a scale. Starting at the bottom, just having the ability to extract data from the consolidated base of systems means that it’s much simpler to transform the data into information and conduct descriptive and diagnostic analytics: What happened? How much was spent and by whom? Why did that happen? Where is leakage occurring?

Progressing up the scale to a more forward-looking perspective, efficiently cherry-picking key insights: Which contracts have the potential to create business risk? How can we benchmark pricing for complex services that are not exactly comparable?

The next rung of the ladder is the ability to transform insights into action, using AI-driven analytics: What is the best sourcing strategy based on X, Y, Z requirements? If an auction is recommended, which format will be most successful? How can risk be minimized in achieving the best possible savings?
Finally, cognitive analytics is where the ability to rationalize and reason brings a level of understanding to the machine-led analysis that allows it to learn and build new models to increase future success: What should be the supplier feedback in an ongoing bidding event? Which RFI questions will give me the best ability to predict bidding behavior? What is the best bidding and negotiation strategy for each supplier? How can this be improved and tailored as rounds progress?

B. Deep-Dives Into the Potential of Analytics Leveraging AI Capability for Source-to-Pay

Example: Spend Analytics

Getting the most from spend data to produce actionable insights, and increase the value added by procurement

[Spend Analytics Process diagram]

Typically, an organization will have visibility of only about 60% of overall spend, with tail and smaller spend being particularly inaccessible. Procurement managers are aware that there are cost-saving and improvement opportunities across their supply chain. However, without the full picture, they’re unable to fully comprehend what spend is avoidable, and what costs are actually enhancing the business’s success.

A common challenge with consolidating spend data is that disparate tools used across the businesses will typically apply different categorizations to the same types of spend. This makes it
more difficult to identify the overlap between them and the themes and issues associated with a given category. For example, in multiple systems, videoconferencing could be known as telecom, collaboration software or audio/visual conferencing. Likewise, supplier name information can be spelled differently, and parent/child relations may not be visible. A sourcing manager’s life is made difficult firstly by pulling together this information, inevitably in different formats, and secondly by having to interpret the category in full.

An AI platform can bring these inputs together and identify synergies between them. The end result may not be perfect, but 95% of the legwork has been done, and AI has enabled the videoconferencing, telecom and collaboration software expense to all sit together. The remaining 5% can be done by people — for example, category managers sense-checking the data and providing feedback for the next iteration.

Identifying patterns and anomalies is how AI can get the most from the data. Some review tasks in procurement are so time-consuming that data is only really looked at on a quarterly or even biannual basis. By the time you come to cleanse, model and review it, it may even be out of date.

However, in our example, now that the data set is combined, the system can flag spend associated with a banned supplier. Before, this visibility may have been buried under the weight of systems and vehicles for using this supplier. Such a mass of data would have required extreme effort and resources to uncover such a hidden anomaly, whereas AI can uncover it easily. The outcome could be a notification to the sourcing manager, or commentary built into a real-time spend dashboard, to indicate that this might be a useful line of inquiry, and that potential value has been uncovered that would previously been too laborious to identify. Casting the net of risk assessment and compliance more widely, analytical tools can be used to perform demand pattern reviews, requisitioner order placement analysis, and price monitoring to flag suspicious behavior.
## Challenges vs. Benefits

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Suboptimal purchasing process</td>
<td>• Make recommendations to improve process</td>
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<tr>
<td>- misclassified data</td>
<td></td>
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<tr>
<td>- difficult to trust reports</td>
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<tr>
<td>• Data sources</td>
<td>• Decision making</td>
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<tr>
<td>- multiple ERPs (disconnected systems and IT support absence)</td>
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<tr>
<td>- multiple supplier and spend data sources and master data</td>
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<tr>
<td>• Quality of data</td>
<td>• Cost opportunities</td>
</tr>
<tr>
<td>- manual data input in purchasing cycle</td>
<td></td>
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<tr>
<td>- GL coding, classification and item descriptions</td>
<td></td>
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<tr>
<td>• High level categories</td>
<td>• Opportunity assessments</td>
</tr>
<tr>
<td>- uncategorized spend at granular level</td>
<td>- decreased spend</td>
</tr>
<tr>
<td>- more focused to finance objectives</td>
<td>- spend economies of scale</td>
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<tr>
<td>• Large time, resource investments to fix</td>
<td>• Fast and targeted sourcing</td>
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<tr>
<td>• Automate consolidation, cleansing and categorization of data</td>
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<tr>
<td>• Dashboard reporting</td>
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<tr>
<td>• Data-driven communications to leadership, etc.</td>
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<tr>
<td>• Enhanced market, supplier, geographical knowledge with category teams</td>
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Figure 10 - Challenges Associated with Spend Analytics and Opportunities for Applying AI

There is also extensive value to be added in understanding what goes into spend. For example, across the thousands of SKUs being purchased, being able to identify the existence and degree of divergence of supplier-charged rates helps to clamp down on price dispersion. Once the like-for-like comparison has been made, it becomes easy to approach suppliers and quickly capture savings.

An area in which it can be a big struggle to find savings is working capital. Using AI and advanced analytics to notify buyers of early payments, multiple payment terms for a single supplier, advanced payment discounts, and so on means that simple steps can be taken to drive uniformity and savings across the supply base.
<table>
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<tr>
<th>Outcome</th>
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<tr>
<td>• Spend visibility – both accurate and granular</td>
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<tr>
<td>• Reduction in total cost of procurement</td>
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<tr>
<td>• Reduction in employee full-time equivalents</td>
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<tr>
<td>• Reduction in supplier lead time</td>
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<tr>
<td>• Increase in orders processed by procurement teams</td>
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<tr>
<td>• Cube refreshing</td>
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<td>• Increased ROI</td>
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<table>
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<tr>
<th>Insights</th>
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<tbody>
<tr>
<td>• Knowing what your total spend is</td>
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<tr>
<td>• Who is spending and on what</td>
</tr>
<tr>
<td>• Which vendors supply multiple business units</td>
</tr>
<tr>
<td>• Which business units buy the same or similar goods and services</td>
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<tr>
<td>• What portion of your spend is with the core suppliers (e.g., top 5 or top 10)</td>
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<tr>
<td>• Total number of one-off and small-value transactions</td>
</tr>
<tr>
<td>• How many transactions your organization processes and the associated administrative cost</td>
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<table>
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<th>KPIs</th>
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<tr>
<td>• Savings as a percentage of actual savings Y-O-Y</td>
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<tr>
<td>• Cost reduction — savings from current and previous costs</td>
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<tr>
<td>• Cost avoidance — savings from unnecessary repair, replacement and damages</td>
</tr>
<tr>
<td>• Total spend under management — direct/indirect material, MRO, business</td>
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<tr>
<td>• Maverick spend — acceptable level and percentage decrease</td>
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<tr>
<td>• Contribution to total spend</td>
</tr>
<tr>
<td>• Item contribution to spend</td>
</tr>
<tr>
<td>• Category contribution to spend</td>
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<tr>
<td>• Supplier contribution to spend</td>
</tr>
<tr>
<td>• Contract pricing and compliance — to ensure contract pricing is maintained</td>
</tr>
<tr>
<td>• Purchase price variance — price paid vs. actual price of item</td>
</tr>
<tr>
<td>• Supplier management — 80% spend through 20% suppliers</td>
</tr>
<tr>
<td>• Supplier performance — price, delivery, quality and service</td>
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</table>

Figure 11 - Potential of AI in Spend Analytics
Example: Sourcing Analytics

Taking e-sourcing to the next level

Starting with the scenario of trying to understand whether a business is buying a similar product from too many different vendors, we can look at how AI can help with negotiation and bid analytics. Entering the given product into the AI sourcing system, NLP can interpret the specification document and the required analysis can be performed automatically. For example, a cost regression analysis could pinpoint irregularities such as unusually high vendor pricing, providing the lead argument for negotiation.

Alternatively, in the instance where an IT buyer is trying to differentiate among three different laptop specifications, a should-cost analysis would identify the main cost components and differences between them and show any outliers in pricing. The system then performs advanced bid analysis that will help sourcing experts find conditional discounts and alternative bids available from other suppliers. Supply risk can be woven into the sourcing equation to ensure that the system only returns compliant vendors and products from financially stable vendors. The result is identification of the vendors to be involved in a bid, with key dimensions of the negotiation strategy already prepared. Insights from previous interactions with the supplier can be added at this stage, such as their historical performance, which bids they have lost or won, and why the result came about. The system can automatically deliver an RFQ to the vendor, and analyze the quote it receives.

The strategy can be remodeled by the system as discussions progress, with a negotiation script summary being delivered to the category manager in the form of developed arguments for the negotiator. This will have been compiled from components such as risk profile, historical relationship, SRM segment (strategic or tactical), and market intelligence (is the price impacted by a given commodity which has recently undergone a large rate fluctuation?). The system learns from each approach, gaining a better understanding of which negotiation techniques are most successful in different conditions, and improving its recommendation capability.

This makes the e-sourcing approach far more sophisticated, demonstrating much more nuance and flexibility in the form of added capabilities such as scenario analysis, incumbency switching analysis and other insights that mitigate risks. An example is outlined in Case Study No. 2, outlining the benefit achieved by an automotive manufacturer in sourcing raw materials.
Example: Supplier Analytics
Choosing and Successfully Managing Suppliers

Tail spend is an area that many sourcing managers find difficult to address on a regular basis and with as much depth as they’d like. The 80% of suppliers that fall in this area are typically not diligently sourced. However, supplier selection and management, especially of those positioned on the operational front line, can be key in ensuring both a high standard of service and customer perception. Using AI to help make the right choices here can grow confidence, drive value, protect against risk and free up time at all levels to think more tactically.

By identifying underlying issues with a supplier, risk can be averted before it threatens the business and its reputation. A sourcing professional wouldn’t be using their time effectively by reviewing a $10,000 contract. Bringing in the speed of AI means that a security check or risk assessment can be completed at speed to learn much more about a supplier. For example, the supplier might be connected to corrupt working practices, breaking the ethics code of a company and causing a potential public scandal. The ready-meal saga in the UK in 2012 revealed that a supplier was using horse meat, tarnishing the names of a number of global brands. Financial information is another key insight in understanding the potential dangers of working with a given supplier; social media and press releases, for example, may have flagged a dip in share price or a risk of bankruptcy that could put a relationship with this supplier in jeopardy.

Supplier Analytics Process

This process is designed to provide a single view of total organization engagement with a single vendor.

KPIs to Capture

- Supplier Score
- % Received Late
- % Received On Time
- % Received Early
- Received Late Quantity
- Received Early Quantity
- % Accepted
- % Rejected
- Average Purchase Cycle Time
- Average Receipt Cycle Time
- Average Approval Cycle Time
- Canceled Amount
- Canceled Quantity
- Received Quantity
- Approved PO Amount
- Approved PO Quantity
During the sourcing process, AI tools can draw on all possible data sources available for a given supplier, including previous scoring in a given category, logged commentary of a sourcing manager’s knowledge, and historical reporting. For new suppliers, crawler technology and NLP can scout supplier websites for key information. From this, they can build up a comprehensive supplier network, provide summaries and recommendations, and even offer advice on everything from supplier assessments and performance management to risk management and compliance. The time it takes to identify the best possible suppliers for a bid can be reduced drastically, and the chance of finding out essential information before the event starts is dramatically increased. The assessment process is also more objective and quantitative, providing recommendations based on fact rather than the bias of the buyer or business owner from previous experience or perception.

C. Contract Management: Making Those Impossible Tasks Possible

Contract life cycle management represents a systematic process in the pre- and post-award scenarios of a contract (pre-award, creation, execution, analysis and management), and if done proactively, can be used to maximize operational and financial performance while minimizing risk. Easier said than done, however. According to the Harvard Business Review, inefficient contracting causes firms to lose between 5% and 40% of value on a given deal. This is typically due to the volume of contracts and variance in their wording, making organization and management a nonuniform, challenging process. Added to this is increasing complexity, levels of compliance, and expectations of value from across the business.

What are some of the elements of successful contract management? Service delivery arrangements continue to be satisfactory to involved parties; expected business benefits, efficiencies and value for money are realized; the business’s obligations are well understood and there are no surprises. Therefore, it makes sense to explore how AI can further expand value in these areas (Figure 13).

Digital contracting is increasingly common, but still demands manual contract analysis, which is typically too expensive in cost and time to extract all the potential value. But how useful would it be, when negotiating the contractual terms of a number of supplier templates, to be able to extract a summary and compare the key terms automatically? By being able to efficiently evaluate the offers on the table, and measure them against what’s currently in place, an in-depth negotiation strategy can be built. Using AI and NLP technology, data can be extracted from documents to automate, accelerate, and improve the accuracy of contract review.
Optical Character Recognition (OCR), which can decipher images and documents, and learning algorithms can read unstructured documents, rapidly extracting critical pieces of data that would have taken days or weeks to assemble.

Armed with statistical and visualization tools, procurement will create a strong fact base to identify points of noncompliance in the S2P process. Analysis will be performed for each category and buying channel. AI and Big Data tools will analyze contracts against spend patterns to identify maverick spend. In the future, this insight could be associated with noncompliant user profiles. It could also help ensure compliance (PO, procurement policy and contract) by identifying products or services that are now redundant internally, or missing out on revenue, for example, by nonadherence to SLAs. In the future, the action triggered from auto-identification of lack of compliance could be a blockchain-enabled transfer for repayment as per the SLA terms.

By using what machine-learning algorithms can do best — understanding contract data and conducting analytics — the links between contracts and rate cards can uncover noncompliance easily. This could take the form of overcharging, missing committed SLAs, or other key value areas, and flagging these for the relevant parties to take action.

A meeting with suppliers can produce a variety of thoughts, opinions and commentary from the buyer and business owner on their product and service offerings. Similarly, through other engagement — RFP exercises and day-to-day interactions — commentary and feedback regarding offers, relationships and compatibility is accumulated. This builds a more nuanced picture of the supplier that a simple database summary may not capture. For example, they might provide pricing with a contractual caveat that breaks an organization's rules, such as an expense policy, or using a supplier presenting financial risk. It's possible to teach an intelligent system to understand internal standards and rules and glean from comments what is acceptable and what is in breach. These may be small tasks that don't take much time, but may be low on the team's priority list.

For example, even though it might take only 10 minutes to review an NDA, it might take a week to get around to the task. If an AI tool is used to review the document, the task and any resulting recommendations can be actioned immediately, for example by flagging any contractual risks to be acted on quickly by the team. Therefore, any issues in relation to the document can be escalated sooner, reaching the decision maker faster and removing bottlenecks from the process.
Identify Contract Sources: Where is contract data available and used in finance system?

- Custom reports
- Summary of transaction-level drill down
- Configurable dashboards
- Ad-hoc reporting
- Pre-built discovery queries
- Report templates

Benefits:
- Time and cost
- Accuracy of automated analysis
- Performance insights — cycle times, deviations, risks
- Statistics — expiry, renewal, pending
- Procurement and sales metrics

Data Sources:
- Repositories
- File shares and server
- After-signing data
- Transaction data: price, discounts, clauses, chargebacks, rebates

Technology Used:
- Machine learning and NLP-based rich analytics
- Predictive modeling
- Data mining and text analysis
- Statistical analysis
- Visualization — Tableau, Qlik, Power BI, Kibana

Figure 13 - Impact of AI on the Contract Analytics Process
D. Influence of Chatbots as Procurement Assistants

Conversational Interfaces, or Chatbots, are AI programs capable of mimicking both written and spoken human conversations. By using a combination of NLP, image and video processing and audio analysis, they simplify the traditional communication with a computer interface, making the experience more personal. As with all AI techniques, the experience of using a chatbot improves with time as it learns from past interactions, allowing it to accomplish more difficult tasks and make its own decisions accurately.

To interact on a human level, chatbots must have an understanding of both meaning and context, which is achieved through semantic analysis — the capability to interpret and apply internal process flows and a knowledge of the relevant information that is specific to that organization.

At this stage, chatbots are not at the point where they can fully take the place of people, but they can improve efficiencies of human communications. Their understanding of the nuance of language, such as colloquial terms or turns of phrase, will require further evolution of the platform. However, just as with other AI applications, bots allow routine, repetitive tasks to be automated, reducing costs and inefficiencies and increasing speed and accuracy of delivery, leaving people to concentrate on higher-level tasks.

Despite the gap between bots and people, there are still numerous reasons to explore how they can help within an organization:
• Instructions can be in natural language, not code or specific wording, providing a much faster, easier style of communication with the user.

• Many back-office functions involve rule-based decision making and large volumes of consistent, standardized input and output data, making tasks within finance, HR, customer service and potentially procurement good candidates for use of bots. This makes complex or time-consuming tasks and decision making autonomous. For example, a bot could be used to automate a purchase order using structured supplier and product information and an algorithm that clearly instructs the bot to action the order in the event of reacquisition data indicating replenishment.

• Now that machines are doing the legwork, the procurement team is able to be as streamlined as possible and focus energy on more advanced tasks — increased savings and value creation to enable improved business strategies, synergies and performance.

• Machines remember everything — they can retain information about past behavior of the user, including previous discussions, decisions, preferences and locations. By linking this to information from other applications such as diaries, contacts, emails and so on, the machine can understand the context of a situation, making interactions more complete and efficient.

• Contextual awareness means that the bot’s customer experience offering, whether internal or external, is personalized while still being automated.

• Chatbots can be trained not just to understand the written word, but voice communication too. Typing is not a natural process; being able to relay information with a voice-based assistant makes the user experience, for stakeholders, suppliers and users alike, much more seamless.

With the increased automation, personalization and natural feel that bots can offer, it makes sense that they have become increasingly common in the service sector, supporting contact center staff in answering customer queries. The range and volume of questions to be addressed can be more easily processed by teaching the bot to provide the relevant response from a stock-answer bank. This format of query and solution is also typical for a procurement support center, which gets questions from both the business and suppliers. The bot can become a single point of contact for
providing answers relating to POs and invoices, providing a guided buying function while the team focuses on higher priorities. Many day-to-day tasks can be delegated to a digital assistant, such as checking invoices against contracts, record-keeping and transcription of handwritten notes on contracts.

Chatbots can be used to speed up tasks not just for the procurement team, but also the wider business. Perhaps someone wants to order a new keyboard, but they aren’t aware that there is a preferred standard from IT, or a price cap of $30 which has been agreed with a certain supplier. So when they search on an e-catalogue for this item, they are overwhelmed by choice and aren’t aware of the restrictions and recommendations in place. A requester can interact with a bot to tailor the purchasing scenario and propose solutions that take into account the needs identified in the conversation, the procurement strategy (preferred suppliers, items, pricing, contracts), and other variables such as historic purchases, compliance or live product availability. Then the approver could be sent an immediate request by the bot, and the approval can happen right away. The bot can then handle the tasks of placing the order, sending a receipt, processing the invoice and payment. The level of automation that can be introduced to the P2P process is again an opportunity for AI and the procurement team to work side by side to maximize the benefits for the organization.

A step further, as the cognitive capabilities of these agents develop, would be to handle increasingly complex tasks. A bot can be connected to systems containing supplier, cost and product data. Combined with the AI capability to analyze inputs such as sourcing requirements, quality expectations and specific supplier capabilities, it could start to determine the sourcing potential of a given product and build a list of suitable suppliers.

The potential of a procurement bot to drive collaboration and digitized innovation across the S2P journey and enhance the customer experience can make it a powerful tool in moving procurement away from its cost-focused image within a business.

E. Guided Buying

In a typical organization, it’s not only the procurement department that is involved with buying activities; the line of business is also directly engaged. Category managers are spending a lot of their energy negotiating better value and establishing contracts with the right suppliers. These
contracts and pricing arrangements may remain as a document in a SharePoint site that neither party has the time to refer to or enforce, resulting in off-contract spend.

Guided buying is another great example of using intelligent technology to make the back office more efficient, as it can be used to prompt users to follow appropriate procurement channels to make the right buying choices (Figure 14). Guided buying consists of a series of questions that the system is equipped with. The answers to these questions will be used to determine the appropriate buying channel based on category of goods, quantity, price, intended use, location and any other key data built into the algorithm. Buyers will then be prompted to create a requisition, or one will be created for them automatically, or a sourcing event or simple spot buy will be initiated.

The benefit is that the requester is engaged prior to PO creation, so procurement has time to act on the need to buy, rather than react to the purchase retroactively. The business is actively yet subtly encouraged to follow procurement guidelines, with just a light touch from the procurement team. Buyers are able to compliantly self-serve the purchase of the correct items, using preferred suppliers, leveraging the product lists, suppliers and contract management that procurement has worked to put in place. This simple web-based or bot-fronted process may eventually become the single point for all purchasing, whether tactical or involving a strategic sourcing event.

The guided buying tool could even potentially be joined to a supplier’s e-commerce tool. The preferred supplier knows far more about what the consumer needs, and can suggest the
personalized product that is most appropriate to the requirements. This level of personalization creates a better customer experience, as well as the obvious supplier benefits. This of course also benefits procurement in the form of supplier control and visibility, ensuring approved suppliers are happy because business is channeled to them. The market intelligence and insights that the tool can bring could be used to mitigate the risk that suppliers deviate excessively from agreed or standard products in proposing unnecessary items at high prices. For example, in a fleet, a standard set of cars should be specified, not Rolls-Royces and Bentleys!

V. Supply Chain

A. Supply Chain Planning

The coordination of a huge number of third-party suppliers required for a logistics team or service provider is not an easy task. The related burden of processing the huge volumes of invoices that these vendors generate falls to the logistics account team. The result of working with so many teams, internal and external, and managing an array of moving parts means that supply chain planning has always been a data-rich process, demanding a lot of analytical power to better understand what it takes to create a well-oiled machine. Despite the increasingly interconnected nature of a modern supply chain, it is not uncommon for systems to be siloed, adversely impacting the ability to access data in real-time in order to react quickly to the unforeseen.

Applying machine learning to the discovery of patterns in supply chain data — the pain points and most crucial factors for smooth, successful management of a network — can be revolutionary. The machine's ability to develop independently means that manual intervention is not needed, and it can conduct analysis without the need for a defined taxonomy or structure. As the data is interrogated under constraint-based modeling, the machine can extract the most influential criteria that impact inventory, demand, production planning, risk and logistics management, and supply chain optimization. Due to the volume and breadth of data on which the system can perform analysis, many of these insights may not have been previously understood or even known. This means that smarter planning decisions can be taken, success is less likely to depend on hunches and intuition, and new levels of network agility and responsiveness can be attained.

Supply chain planning has typically relied on historical data. This of course has its downfalls in that unexpected changes to weather or demand are not foreseen and therefore cannot be allowed
for. Synchronizing the complex planning demands of suppliers, customers, inventory, logistics and production can empower the rest of the business to drive strategic initiatives that support the success of the network. For example, when a customer contacts a manufacturer for expected delivery time for an order, and this information is not on hand, the customer has the option to contact another supplier. The sales team can be better informed, however, if they have an accurate picture using cognitive supply chain management technology, which performs analysis and provides notifications automatically using layers of data streams — maximizing service and minimizing costs simultaneously. Collecting data from sensors and mobile phones on weather, location, disruption, congestion, historic shipping data, temperature and other sensitive conditions enables analysis of this data to gain live visibility of shipment progress, as well as provide more accurate indicators of departure and arrival times. In turn, this builds customer trust because the operation can provide reassurance of location and understand the reasons for service delays, as well as reduce the number of lost shipments.

Predictive risk management is crucial in maintaining continuity and the flow of components and resources across a global network on a daily basis. Using NLP techniques to crawl social media and online sources to decipher key content and related context, disruptions such as material shortages, labor actions or even legal investigations can be flagged and corrective actions taken in advance of a problem arising.

Third-party providers in the risk planning space also relieve the potential inaccuracy of internal data sources while providing the capability to access and consolidate the multitude of external data sources — something that may not be achievable by the organization itself. Kaazing’s Disasteraware product is connected into U.S. National Weather Service data sources, among others, to understand what political events, natural disasters, weather conditions, and other active situations might disrupt a business.

It’s not just the unexpected that can be improved; having a better insight into causals can help to improve processes and optimize margins. Predictive modeling and machine learning algorithms can identify where costs can be minimized or where bottlenecks exist to ensure assets are sweated and supply plans, inventory and transportation are in the best possible state. Again, the business can drive customer service — optimized inventory, supply matching demand, fleet efficiency — while saving on storage, procurement, production and logistics costs.
As the level of delivery service provided in the B2C environment has improved, the same customer expectations of time-slot deliveries, ad-hoc pickups and instant delivery have spilled over into B2B logistics. Intelligent route optimization has features such as real-time routing algorithms for fleets, which leverage sources including satellite maps, traffic flows and social media check-in locations. This improves navigation for truck drivers, and therefore the route of the shipment itself.

From fleet, to risk, to the day-to-day running of the operation, logistics managers can have a better handle on what is making their supply chain tick, using the capabilities afforded by AI. In turn, they are helped to make better-informed decisions and build business strategies to enhance productivity, customer service and revenue.

B. Demand Sensing and Inventory Management – Improved Supply Chain Planning

It is practically impossible to predict all the elements that might impact demand; for example, a surprisingly warm and extended autumn in the UK in 2017 led two of the largest clothing retailers — Marks and Spencer, and Next — to report a decrease in sales. However, there are many more events that, with the right technology in place, can be captured to enable improved reactions of CPG companies and retailers to consumer demand. By having a better understanding of end-consumer needs, supply chain operational teams can make improved, more reliable predictions for
demand planning and management. For example, how are online retailers such as Amazon able to offer thousands of products that will arrive at your door the same or next day? By building a forecast, based on AI-driven consumer insights, of what products are most likely to be ordered, they can transfer them to the nearest warehouse to the anticipated demand, in preparation for that “add-to-basket” click.

As a result, the supply chain can be better managed, improving customer service. Knowing that products will arrive as soon as possible improves customer delight, while improved planning means that more products are delivered as promised. Enhanced levels of satisfaction give the incentive for the consumer to return again and again, increasing the amount of spend through the channel.

With improved accuracy of demand predictions, fewer unwanted items are returned to the supplier. Further savings are therefore seen in warehousing, administration and transportation. A more cost-effective, streamlined and revenue-driving supply chain is an easy sell to the wider business when the goal is to encourage investment in demand-sensing technology.

How are these consumer insights generated using AI? By mining the many different data sources that have been generated through customer interaction with products, algorithms can be built to generate demand predictions. This analytics model takes downstream data from warehouse withdrawals, distributor and retailer forecasts, inventory channels, and point-of-sale data to build a single comprehensive data set, containing key indicators of where the consumer’s interest lies. Machine learning makes the formerly monumental task of consolidating these data sources and finding the embedded trends a near-instantaneous activity. The results are immediately relevant and can feed into other functions in the supply chain process, such as reordering of inventory.

There are examples of companies building this functionality in-house, but for those that would prefer a third-party solution, the market has numerous cloud-based SaaS offerings. Since 2013, the latter has been implemented by Procter and Gamble with the rationale that traditional demand-forecasting methods are incompatible with the more uncertain economic climate, new markets and products that currently affect their supply chain. German retailer Otto pursues real-time decision making enabled by the daily-generated forecast produced from data inputs of hundreds of variables. They have seen astonishing results: 40% increase in item-level forecast accuracy and a 20% reduction in overstock.
Regardless of how the technology is implemented, most companies already have the data required to leverage demand-sensing insights. The most obvious applications, such as the two examples above, are for Fast-Moving Consumer Goods (FMCGs) companies where lead times are short (4-12 weeks).

The more data sources that can feed the system, the more the machine learning capabilities can learn and be fine-tuned to an organization’s particulars. Most will be able to leverage typical internal structured sources: the POS system, inventory management or sales reporting. However, less obvious internal sources of unstructured data, such as marketing campaigns or apps, can feed in more easily in a connected cloud platform. The third source, which may have been less commonly used in traditional forecasting, is external data, again structured: news and economic reporting, weather forecasts — and unstructured: social media, chatbots or devices connected to the supply chain.

In the Asia-Pacific region, where consumers shop in air-conditioned malls, hot weather makes little impact on demand. However, the impact in markets with typically cooler climates could be to drive shoppers out into the sun. Context is key in interpreting the results of the insights, but regardless, supply chain planning is made that much more intelligent and responsive, as demand-sensing algorithms provide much more effective early-warning signals.

The advantages are manifold:

- By handing over the manual process of combing through required data sets to an automated process, supply chain professionals have more time for impactful, longer-term-view activities such as risk planning. This also reduces the operational costs of manual planning.

- A more efficient demand-management plan means improved stock level accuracy and therefore, sales.

- Backup stock buffer levels are reduced, so less manufacturing time is dedicated to producing these items and tied-up capital is released.

- Inventory can be optimized and replenishment plans developed more accurately.
• Businesses can order products ahead of time and potentially shape customer demand — for example, through targeted marketing, price incentives, or providing substitutions.

VI. HOW CAN PROCUREMENT IMPLEMENT TECHNOLOGY TO MEET THE AUTOMATION IMPERATIVE?

A. Implementation Strategy

When it comes to implementation of new technology, the overall company strategy is a good place to start. Using the defined framework and guidelines that the strategy sets out, it can be assessed how procurement, or the operation, sits within it, and what the value proposition will be to the company. From here, the key areas that AI should target can be determined, making it easier to identify how the technology should be leveraged. For example, perhaps the fundamental issue is transparency, so applying AI at the most granular level for data consolidation, cleansing and categorization would be the obvious goal. Alternatively, if the organization is more mature in its data cycle, identifying the key opportunities in value-add that can be channeled to an AI solution makes more sense, whether they be process efficiency, resource optimization, or improving business partnering.

Once the value we expect to be delivered is understood, an overarching AI strategy can be defined, including considerations of the data involved, the platform(s) it resides on, and the AI-based tools and techniques used.

Procurement involves transactions that are layered across business, so it is key to understand, for these types of transactions, what type of question should be asked of the data, e.g. binary — is this activity fraudulent: yes or no — or linear — a more complex, multidimensional challenge such as recommending a correct supplier for an RFP.

B. Platform

Regarding the platform, what is the most appropriate? The most advanced could be a series of highly-optimized libraries, using neural networks with supercomputer-level power, which would be necessary when the time to compute is essential. This would be assessed from both the speed
of extracting insights needed and how much cost can be invested in a data science team. A more common platform, used by the likes of Google, would be cloud, which also offers power and structure.

No matter how implementation is approached, one certainty is that Big Data, the foundation for the transition to these cognitive technologies, already has a firm foothold in many organizations. Data warehouses, whether they be centralized or distributed, have true potential to boost corporate growth, a significant part of which can be driven by digitized procurement practices. Modern, unified S2P platforms are also a perfect launching point for reaping the benefits that these new technologies have to offer. Why? A unified S2P platform enables linkages between sourcing and contract, contract and catalog, catalog and ordering, ordering and invoice. Automation is already built in at source and data is both created and collected across the various steps of the procurement process. This data engine can be leveraged by the new emerging technologies to accelerate efficiencies and thereby increase procurement’s value to the business.

C. People

Another key consideration in undergoing such seismic change is the impact on people — both the in-house teams needed to facilitate implementation and the end-users that will see transformation to their ways of working. In terms of attracting talent, both the supply chain and procurement are in the fortunate position of having a wealth of data — which is what attracts data scientists.

D. How Service Delivery and Relationships With Internal Customers Will Be Impacted

The penetration of technology in professional services will also introduce changes for category managers in the way they will interface with external and internal stakeholders.

a. Impact on External-Facing Interactions

• Opportunity to renegotiate prices and generate savings:

  ▪ It is important to consider that service providers are themselves embedding
automation tools to scale down their own cost of service

- Service providers claim cost efficiencies ranging from 15-35% in service delivery (depending on whether the FTEs are onshore or offshore based) with automation replacing human effort
- This is likely to lend itself to pricing cuts; category managers need to leverage the situation to renegotiate pricing with their service providers

- A shift to outcome-based engagement approaches:
  - Automation technologies will reduce dependence on talent and manpower, and shift focus from FTE-based selling approaches to outcome-based
  - Pricing models — especially Time and Materials and Fixed Price, which factor in staffing and turnaround times — are likely to give way to outcome-based pricing approaches

b. Impact on Internal-Facing Interactions

- Business units to share sourcing budgets:
  - Both procurement’s and operations’ relationships with internal customers are expected to experience a massive change as they provide a different type and level of service within the business
  - Budgets for sourcing the digital enablers aren’t centralized to a strategic business unit or with procurement — they are spread among various business units and stakeholders who must collaborate closely across sourcing events or the supply chain
- Uneven supplier landscapes will pose challenges:
  - The supplier landscape for the digital tech enablers across professional services categories is still emerging and is highly fragmented
This will require significant effort from procurement in two aspects: first, keeping a close eye on the highly dynamic and emerging supply landscape; second, understanding how new relationships should be structured — few or no benchmarks will be available for driving commercial and contractual specifics.

A shift from a pure operational mandate to a more strategic one is imminent.

E. Phased Adoption of Automation, Starting With RPA and Progressing to AI

Distinct value propositions of RPA and AI technologies and the differences in maturity of the corresponding vendor landscapes will result in the “smart automation” agenda being enabled in phases. Senior procurement executives have disparate objectives and differing urgencies where RPA and AI implementations are concerned. CIOs enabling the smart automation agenda within procurement should be aware of the following:

- **Enabling platforms for smart automation will cater to distinct use cases.** While RPA will be leveraged in the immediate term with use cases largely restricted to P2P processes — PO creation, data management, vendor master data creation, reporting, order acknowledgement, invoice scanning and settlement, etc. — the impact of AI will largely be felt in upstream S2C processes: spend classification, opportunity analysis, market intelligence, contract authoring, RFx management, supplier risk mitigation and management — and select P2P activities: guided buy and help desk.

- **Ongoing pilots are expected to boost AI’s adoption in the next 12-18 months.** Unlike RPA’s focus around cost avoidance and greater savings delivery, AI initiatives tend to focus on insight-driven decisioning. AI’s ability to stretch beyond “swivel-chair interfaces” — labor-intensive tasks in the downstream P2P activities — helps it differentiate from RPA. While AI’s maturity and adoption in procurement currently lag RPA, future adoption growth rates will exceed 240% (see endnote 4) over the next two to three years. The current vendor landscape is highly fragmented and targeted, with smaller and niche vendors catering to specific use cases. Traditional vendors are expected to adopt a combination of organic and inorganic strategies to expand their AI capabilities and offerings (see endnote 5). Use cases catering to contract and spend management are expected to precede the more complex ones around market intelligence, guided buy and supplier management.
• **Gaining business buy-in through demonstrable business improvements.** The impact of AI across sectors can be authoritatively demonstrated through numerous case studies of users who have taken an early leap to automate select S2C and P2P processes. These can be used to encourage interest from across the business and organizational buy-in for investment and project initiation.

• **Building up at a manageable pace.** It makes sense to spread the risk by not going for a cross-organization approach. Instead, work on a case-by-case basis and expand once learnings have been gathered and trusted supplier relationships have been established. By targeting specific problems with AI solutions, a more positive outcome is typically seen. This means teams can build confidence; putting a lot of hype and focus on a broader project and requiring intensive administrative and resource dedication can damage optimism. Taking the time to understand where the biggest value can be extracted, and then delivering a shorter project with well-defined objectives, acts as a good testing ground before expanding the AI reach.

### F. Challenges Associated With Implementation

The introduction of new technologies, systems and processes naturally has practical implications for the wider business. Ensuring successful integration of a system with the existing architecture is often a challenge. This is of course further magnified in a digital world that is still new territory for
most organizations, and suppliers, expert resources and in some cases the technology itself are still becoming fully established. Being prepared for what to expect is the first obvious step in planning mitigating actions when preparing for implementation.

a. Explainability

With a far more accurate and in-depth understanding of organizational spend, there is expected to be a boost to mutual confidence — from the business and procurement — in sourcing’s reporting. In turn, this will help make procurement more credible with stakeholders. However, the question will understandably be asked: “How was this figured out?” When an insight has been delivered by an AI-powered platform, we can’t always understand immediately why the system arrived at the decision it did. If something cannot be explained, it can become hard to justify to the business, and therefore to achieve the desired actions prompted by the data-driven insights. To address this, the process that the data has undergone must go through various checks and balances. Transparency is needed in how the network was created and why, as is a comprehensive understanding of the training data used to build the machine’s cognitive capability. With these in hand, the individual or team impacted by the decision can understand why it was made, providing reassurance to the business that the insights and recommendations driven by cognitive analytics are explainable.

b. Organizational buy-in

A key consideration when initiating an AI application project is “How do you get the organization on board?” When presenting a business case to leadership, it may require building — or the leaders already possessing — a fairly in-depth understanding of AI technologies and their potential impact on departmental processes, so that the opportunity is comprehended. A lack of familiarity around the subject, understandable with such a nascent field, may require well-considered repositioning to get to the level of thinking and working required.

Once the business case has been signed off, this learning curve must be expected for the wider organization to ensure successful roll-out and delivery. Assume that only a limited subset of employees has a sufficient understanding, and think about how this might impact their consideration of risks. Suppliers have the potential to “over-egg the pudding” in terms of benefits, which could leave people disillusioned and de-motivated. Using education to ensure
a reasonable level of comprehension can help to mitigate such factors. Building on the internal education, creating on-the-job training can contribute to skill development. This is of course an investment, but sets the business on the right path to ensuring the ROI of AI is achieved — staff will understand the full potential and can maximize the associated productivity and value-add benefits. This speeds up identification of systems and processes that aren’t working optimally, since a team with a fundamental knowledge of how to use AI will move away from manual activities to insight-driven, problem-solving behavior, indicating where there are underlying issues.

c. Identifying true AI suppliers

There is the chance that some product offerings that are presented as machine learning may instead implement lower-level technology such as predictive analytics or partial machine-learning capability. In addition, some entrants are engaging in sectors that have less experience in AI implementation, meaning achievements could be less well validated. How can a lay organization tell the difference? Identifying the suppliers that have a true offering is fortunately made straightforward by the fact that AI is not a technology that is easy to fake. For example, if the logistics team wants to use AI in the form of intuition robotics in a self-driving truck, only a truly intelligent system would be able to recognize what action a cyclist is potentially going to take.

However, some applications are less obvious to test. Procurement should ensure robust supplier verification processes such as an RFI, building a database of vendors and top AI use cases, or working with an advisory team to do so. Questions that elicit a thorough look into the product and service offering — how does it work? What data is used and how? How is AI functionality used? What does integration involve and what are the steps? By whom and how has the technology been used before? — mean there are fewer places to hide in terms of marketing collateral and jargon. This ensures a further degree of confidence and can be a worthwhile step in ensuring the maximum return.

d. Finding the right expertise

As we have touched on, it’s not expected that the workplace is prepared with the relevant skill sets for such an emergent technology. There is not going to be an abundance of talent within
an organization to build and lead the AI transformation once the strategy has been defined. And because this resource is not abundant in the workforce market, investing to bring in professionals to deliver the goods can be expensive.

There is a twofold approach to addressing this issue. First, as mentioned earlier, internal up-skilling; but this of course takes time, and hampers a company’s ability to hit the ground running following technology investment. The best solution currently available is to engage external expertise. Suppliers that have been successful in offering AI solutions to the market will generally comprise a team with deep knowledge of the software’s capability and how an individual organization can embed the current systems, as well as get the most from them in a particular field or function. Having gone through the audit mentioned above as quality control, this source of experience can be brought on board on a temporary basis to ensure successful roll-out from the start, while avoiding the long-term spend of building an internal resource from scratch.
VII. CASE STUDIES

A. Case Study 1: Contract Analytics

Authoring, vetting, and analysis of contracts can be a painstaking, many-stage process. We have already discussed how applying machine learning and NLP technology to data extraction from contracts can transform the process flow and introduce new levels of accuracy and speed to contract review. Optical Character Recognition (OCR) and learning algorithms can read unstructured documents. They rapidly extract critical pieces of data — contract expiry, pricing sheet, pricing conditions, SLAs, key legal clauses, and so on — that would have taken days or weeks to assemble.

A large corporation purchased an AI-driven cloud solution to extract and track data from 225,000 contracts across its procurement, sales and HR departments. The particular issues that this organization faced, common across many, were how to sort all of these documents once they were in the platform and how to extract all of the necessary items from their contracts. By determining workflows and how best to organize the documents in advance, tagging and filtering functions could be built into the platform before implementation, giving the structure and easy access needed. Once extracted, the data could be easily tracked within the system using dashboards and filtering mechanisms.

So what was the shift in manpower and associated costs? Originally, there was a core team of 25 people spread across the three departments that used the software for different applications throughout the course of the year. Each member of the team was responsible for extracting and tracking relevant data from 1/25 of the contracts, or 9,000 contracts. Assume it takes 20 minutes to analyze and extract the relevant data from each contract — this would equate to 3,000 hours per reviewer. If we assume each team member’s average salary equated to $63/hour, then the total cost before the technology was implemented is 25 x 3,000 hours x $63/hour = $4,725,000 per year spent on contract review.

The technology implemented is able to conduct a review in half the time. If we factor this in, along with an investment in the technology, the company has reached an ROI of:

Savings using AI technology: $4,725,000 x \( \frac{1}{2} \) (average time saved using software) - $404,000 (cost of software) = $1,958,500


Now the team members across all the teams have 3,000 hours of time banked with the software, giving them the opportunity to really understand the contracts and to focus on key activities, such as building the ideal contractual terms with a supplier, and plan negotiation strategies ahead of renewals.

B. Case Study 2: Using Advanced Sourcing Optimization to Negotiate Metals Contracts

One technology provider has developed an eSourcing software-as-a-service (SaaS) that is backed with a sourcing optimization engine and scenario analysis capability, covering functionality in intelligent bid sheet design, RFxs, eAuctions, and analytics, among others.

A global supplier of automotive parts and components was exploring options for assistance with its annual contract negotiations for carbon steel and stainless steel. The automotive industry is famous for its relentless focus on cost. A rapidly evolving competitive landscape means that automotive suppliers need to be more nimble and innovative.

In a rising cost market, this manufacturer sought a more efficient means to evaluate and award contracts to minimize price risk, reduce supplier risk, and place more spend under management to solidify margins (ultimately improving EBITDA). With North American spend north of $75 million, primarily on stainless and carbon steel, the supplier’s top goal was to ensure a cost-competitive supply base without compromising quality or delivery. It also sought to rationalize its supply base and reduce supply risk for select subcategories. The supply base of over 30, spread over three locations, was fragmented, with too few suppliers for some alloys and too many for others. Two distinct projects were run for the main products in scope: carbon steel and stainless steel.

For both categories, a standard sourcing methodology was deployed, with the small twist of using sourcing optimization software to evaluate contract awards and supply options.

Baselining metal prices can be a challenge for carbon steel, particularly when the buying organization uses an index (such as CRU) on a quarterly adjusted basis. Using receipt-level data provided from the automotive supplier, the team created an average price by SKU by quarter. This made it simple to compare the prices from the bid process against the historical baseline.
Experienced sourcing organizations, such as this one, know to ask suppliers to break down processing/value-add costs from the underlying metal costs, to place more spend under a fixed price arrangement over a period of time. Letting the software analyze this process enabled the buying organization to better understand overall competitiveness for each supplier while creating SKU-based award scenarios with fewer suppliers.

In rising cost markets, buying organizations can reduce risk in a number of ways. This project used three mitigation methods:

1. Develop a project timeline
2. Deploy relevant tools/resources for the engagement:
   a. Benchmarking software allowed the team to quickly, efficiently and accurately understand hidden risks and hidden sourcing opportunities, as well as instantly identify alternative sources of supply
   b. Using the input of a metal price forecasting service provided monthly insights on specific buying behavior to match underlying market trends
   c. The sourcing optimization software itself served as the bid platform for all the suppliers to detail out the value-added processes, discounts, and so on, as well as conduct the preliminary RFI and manage all bid documentation
3. Award annual contract based on the results of the software’s AI-driven analysis

What advantages did the bid optimization technology deliver?

- 100+ line items with multiple suppliers — supplier optimization is the only way to manage this level of complexity efficiently
- Fast and efficient configuration of feedback on line-item basis to bidders based on intelligent rules and benchmarking data
- Elicitation of package bids, which can discover economies of scale and scope that are otherwise hidden
• Complex bids with more than a dozen suppliers, which allows for easy comparison and analysis

• Stakeholder alignment — helping management, finance, operations and other team members understand the cost of specific decisions by quantifying the cost of constraints

• Keeping incumbents “honest” but without the stigma of a reverse auction process

• Allowing for on-the-fly scenarios to shorten the contract award cycle

• Identification of new and competitive suppliers not previously known to the buying organization, and allowing them to “put their best foot forward” based on their strengths

The end results, both quantitative and qualitative, were exceptional:

• $2M identified savings

• $1.5M implemented savings

• 69% supplier rationalization for carbon steel

• A streamlined contract awarding process, getting to awards faster

• Bid optimization — key to reducing complexity with so many SKUs to bid

• Much faster delivery of the supply base rationalization process via the software than running a bidding event

• Easier acquisition of the additional value seen in multi-round sealed bids

C. Case Study 3: Supply Chain Optimization

A cloud-based platform combining AI and prescriptive analytics was established in 2014 and quickly grew to be the provider to leading fashion and collection-based brands, including Kiko Milano, Pepe Jeans and Stefanel. The provider saw an opportunity in the decision-making process in the retail supply chain, particularly that of fast fashion. Many of these organizations
are immature in their technology capabilities, and most decisions are made based not on good visibility of data along the supply chain, but on instinct — not an especially robust mechanism!

This provider has used its technology to create a better understanding of demand, and to allow those planning the supply chain to make better informed decisions across inventory management and planning, targeting four key areas every retailer faces: buying, first product allocation, replenishment and store transfers. The platform provides an optimization engine for sales using a demand forecast, coupled with the most advanced retail-specific BI. This looks at the expected probability of demand for each product in each store, and matches this with distribution management to ensure correct stock levels correspond as closely to demand as possible. The typical model for demand is to keep "most popular" stores the best stocked for each item; however, this doesn’t always pay off. There’s no guarantee that all items will be the most popular just because they are in a flagship store. The platform provider’s method is more sophisticated. The results seen for some of its global, leading fashion brand customers are increased revenues by 5-10% and inventory improvements of 30%.

How does its demand-sensing platform do this? By using a vast range of data sources, taking into account an array of variables that may impact logistics and demand. Event data, weather forecasts, social feeds, ERP and/or End-of-Sales systems can all be consolidated to quickly build an accurate picture of what is going to sell, where, and in what volume. The system can also help to improve commercial performance, as it can assemble a list of products where the stock accuracy is very low, and assimilate the data to better understand, for example, why a given item is not selling, or if the data itself is accurate. The algorithms are built based on the latest fast-fashion operations research, which can be extended to other verticals with constant product introduction and short product life cycles.

So how easy is the technology to add into the operation? It is possible to start with a basic level of the organization’s systems inputs — obviously more is better, but this means an ROI is seen much faster. In terms of integration, this is fairly light and implementation lead times are usually around a month. Typically, clients aren’t always operating in a best-practice model for data management and forecasting, because historically this part of the business is not especially mature in its AI technology capabilities. Therefore, it’s relatively easy to implement the technology, as the team is not building on existing in-house AI capability. This makes the
product virtually off-the-shelf, as it tends not to need to be adapted to work with similar platforms.

Fortunately for this software company, its customers are increasingly willing to participate in data gathering; this allows them access to a database compiled from many different retailers, enabling them to better understand the competition and insights about their own products. For example, is your red dress selling because your dress is good, or because red is in fashion?

As the industry begins to see more supply chains becoming optimized in distribution, this software company sees its next step on the horizon. Its customers want the same ability to understand the downstream to be applied to the upstream. In fashion, the example is using AI-driven platforms to support decisions about which product they should buy and volumes of each, based on inputs such as predicting market trends.

**VIII. A LOOK INTO THE FUTURE**

The thoughts of the range of suppliers and industry adopters that we have gathered in conversations surrounding AI share a common outlook: initial uptake will not be comprehensive across all procurement and supply chain processes. There are so many factors to consider in implementing the technology: rate of development, talent and resource, strategy, business buy-in, and so on. It’s not that companies don’t want to overcome these potential roadblocks, but they mean that AI adoption is likely to occur in a staggered manner. Certain subprocesses which can be considered as low-hanging fruit — contract administration, spend classification, guided buying, risk monitoring — will lend themselves to earlier AI deployment. Success in these areas would contribute toward further strengthening AI’s business case for more complex processes — contract drafting, opportunity/savings identification through spend insights, market intelligence, help desk automation. Understanding the foundations of AI that will be the game changers in the earlier instances will help to build the stepping stones to organizational success.

We believe these foundational building blocks are where implementation will start for most organizations: first establishing a solid data platform, then showing the business benefit of driving savings and efficiencies and exploring predictive analytics, before progressing to the more advanced capabilities.
As procurement continues to experience the digital onslaught from multiple disruptors, the most notable being smart automation, CIOs will need to step up and pursue technological transformation together with the CPO to enable procurement’s digital change agenda:

- The litany of literature highlighting the success stories and the rapidly evolving supply landscape can instill a fear of missing out, causing a “big bang” adoption approach. CIOs and senior procurement leaders must realize that there are currently different levels of maturity of smart technologies, and accordingly chart out their adoption plans. While now is a great time for driving AI business cases and adoption, decision makers must consider a 6 to 12-month time frame with respect to adoption of AI technologies. Generating early wins by grabbing the low-hanging fruit first — upgrading the “swivel-chair” activities through automation processes — will be crucial in securing easy buy-in for the more complex AI programs in the future.

- Immediate priority should be on downstream process automation. In cases where the management of downstream activities has been outsourced, it’s important to have discussions about redefining service-level expectations and pricing arrangements with the service provider. In cases where a sizable portion of the downstream activities is hosted within an internal center of excellence (CoE), organizations must prioritize building business cases to push ahead with the next steps in their automation agendas. Firms will also need to structure a change management approach, considering the RPA initiatives are likely to impact and displace the internal blue-collar profiles.

- Stagger your AI-adoption plans over a one-year time horizon; CIOs must also pursue an upstream process automation agenda which is expected to be led by AI technologies. Select processes within contract life cycle management and spend analysis — namely contract vetting, redlined version generation and spend classification, which are gaining traction at an accelerated pace — need to take precedence in the immediate term. However, a set of more complex AI algorithms targeted at automating processes such as market intelligence, analytics-driven savings opportunity identification, guided buying, contract drafting/authoring, RFx response and evaluation, among others, can be prioritized over the next 12 to 18 months.
• Lack of data integration and quality of data have emerged as the biggest barriers to adoption of smart automation within enterprises. Such limitations are a cause of high organizational anxiety, considering that a structured and coherent data lake is a basic requirement for most AI initiatives. Focusing on overhauling data strategy and marrying AI with advanced analytics through internal CoEs is certainly a best practice, especially for highly-regulated industries such as banking, financial services and health care. However, easy availability and costs related to training and retaining talent are yet another challenge, but can be overcome by an ecosystem of enabling partners.
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This paper makes the case for CPOs to rethink their approach to people, processes and technology. By doing so, they can free themselves to come fully into a strategic advisor’s role, focused on three critical priorities: managing risk, creating value and being agile enough to respond to threats and opportunities.

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