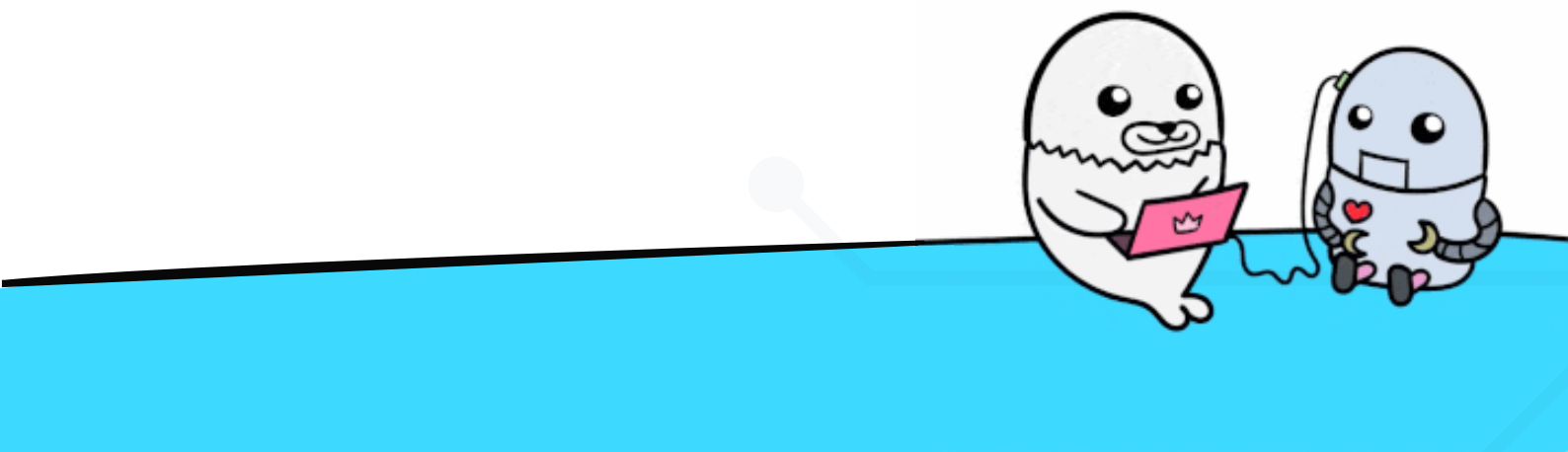
AI
in Procurement

The Ultimate Guide for Procurement Executives.

Including Definitions, Examples and Best Practices.

Sievo



AI
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Artificial intelligence is one of the hottest topics in technology, but it is still a relatively new opportunity for Procurement.

Often AI is talked about as a magic new solution to problems. Too often, talk is about future potential instead of business reality.

This guide helps you cut through the hype and identify the real business opportunity in AI today. We include many definitions and examples intended for Procurement professionals without prior knowledge of the topic.

Read, think and enjoy!

What is Artificial Intelligence in Procurement?

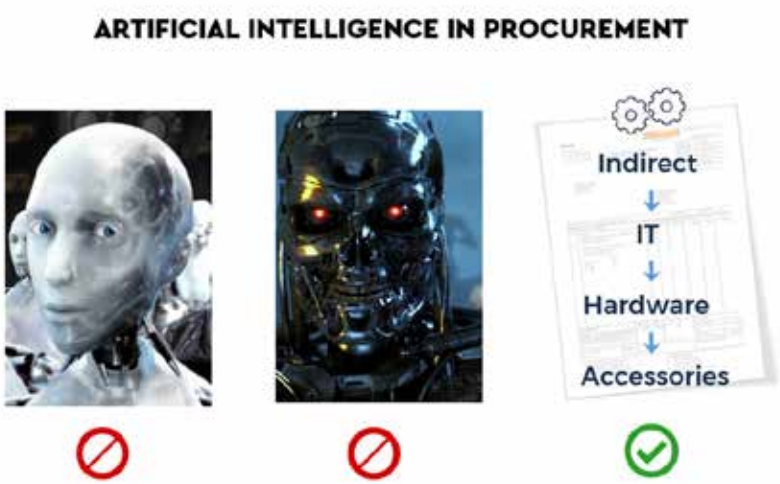
Artificial intelligence allows Procurement organizations to solve complex problems more efficiently or effectively using smart computer algorithms. AI can be embedded into a number of software applications from spend analysis to contract management and strategic sourcing.

Artificial intelligence has been a field of academic study since the 1950s, but only recently has it found concrete applications within Procurement functions. On a high level, AI is a broad set of new computer technologies with the ability to learn and adapt their behaviour. Typically, AI software is developed to solve complex task better or more efficiently than humans.

Strong vs. Narrow AI

Many of the depictions of AI in popular media refer to strong AI, which is also called artificial general intelligence (AGI.) In the classic science fiction movies The Terminator and I, Robot machines are depicted to perform intelligent tasks at a similar level to humans.

On the other hand, all known applications of AI in procurement today reflect narrow AI, which is also referred to weak AI. They focus on smart solutions to very specific and defined tasks. While they may be limited in scope, narrow AI has the more immediate potential for improving operational efficiency.



What is not artificial intelligence in Procurement

There is a lot of hype and misunderstandings surrounding artificial intelligence. From a Procurement perspective, AI is not a chrome or plastic –plated sentient being as you see in movies. It should not be seen as a replacement of human Procurement expertise, or to be considered a new team member capable of driving organizational change, strategic sourcing or realized savings. For Procurement, AI is not a magic solution you can tap to solve your problems. All AI solutions today in Procurement will require active expert guidance and oversight.

What is artificial intelligence in Procurement

Artificial intelligence is, however, already transforming Procurement. AI is automating or improving many time-consuming tasks or giving Procurement experts additional insights based on extremely complex and large sets of data. In simple terms, AI is simply a software solution aimed at resolving a specific task. Because AI is just software, it has the potential to rapidly change work practices across even large organizations. When you think of AI, look beyond the hype and just consider it as a new type of software.

What is Artificial Intelligence in Procurement?

From a Procurement perspective, any software solutions that include self-learning, smart algorithms can be considered AI. You can see examples in later chapters of this guide and refer to these common definitions.

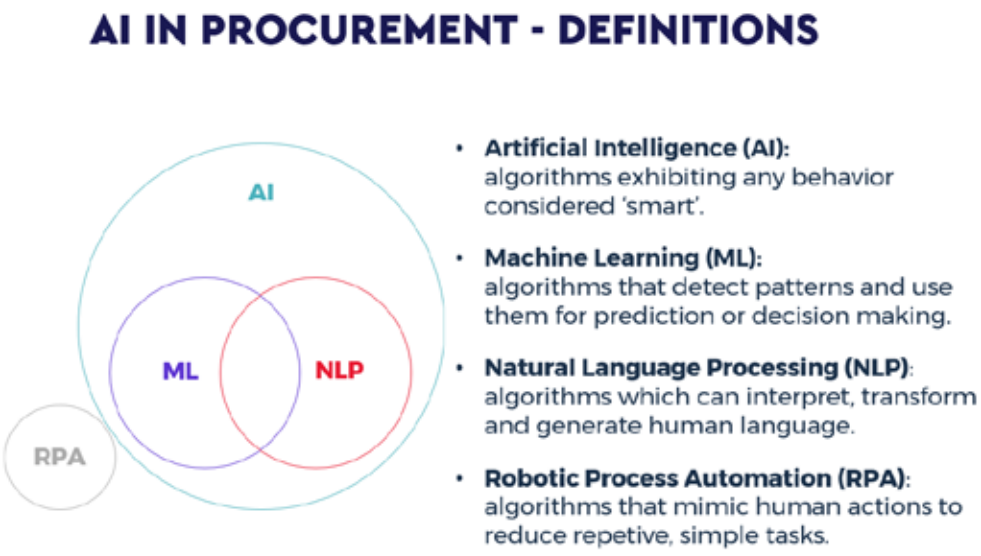
Artificial Intelligence (AI): any algorithms exhibiting any behaviour considered 'smart.'

Machine Learning (ML): algorithms that detect patterns and use them for prediction or decision making.

Natural Language Processing (NLP): algorithms which can interpret, transform and generate human language.

Robotic Process Automation (RPA): algorithms that mimic human actions to reduce repetitive, simple tasks. RPA is generally not considered a form of AI.

All forms of artificial intelligence involve algorithms – sets of rules specifying how to solve a specific problem. Algorithms can be calculated by anyone gifted in math, but they also form the basis of most computer software. The work of algorithms in software is not visible to the human eye, but they can be programmed and re-programmed by experts to solve problems deemed important within software environments.



While Robotic Process Automation (RPA) offers Procurement many opportunities to improve process efficiency, it should not be considered as AI. For simplicity, think of RPA as a software robot that mimics human behaviour, while AI is a simulation of human intelligence.

Examples of Artificial Intelligence in Procurement

While the adoption of AI in business applications is in relative infancy, there are an increasing amount of examples of AI being used within Procurement functions. Some of the most common approaches include:

Spend Classification

Using machine learning algorithms to classify procurement spend into categories and sub-categories. For example, reviewing millions of invoices to automatically categorize spend in different categories of cardboard packaging.

Transactions

Spend	AI suggestion	AI confidence	Material	Vendor	Account
573,94	Packaging > Cardboard > Cardboard boxes	0,59	Box 20x10	DS Smith Packaging Pakkausjaloste Oy	Cost of Production - Packaging Materials
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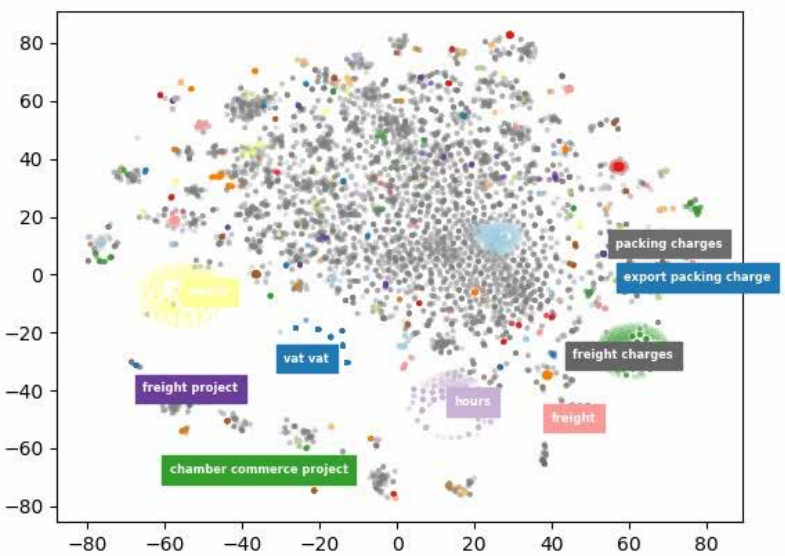
Vendor Matching

Using machine learning to connect supplier data contained in invoices and purchase orders to a vendor hierarchy. For example, connecting different local subsidiaries of a freight and logistics company to one international supplier.



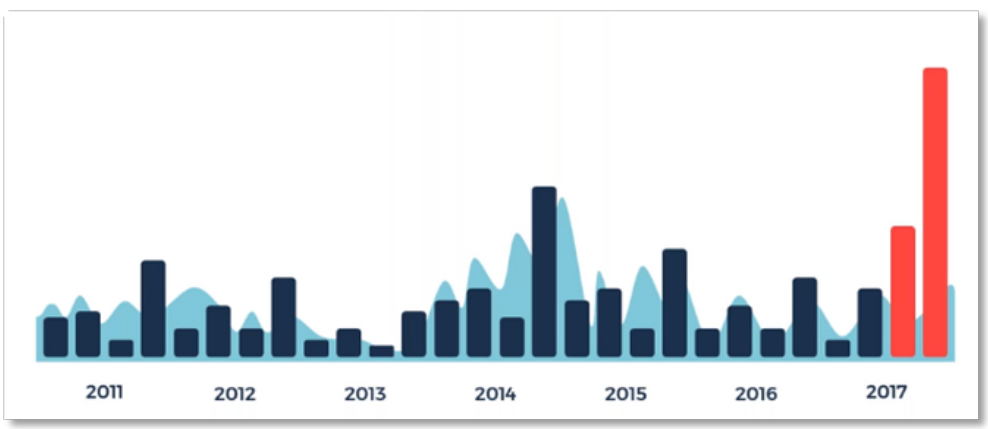
Capturing Supplier or Market Data

Use techniques such as natural language processing to look for and capture data on suppliers or specific markets. For example, tracking social media channels for signals about suppliers risk positions.

Photo credit: Riskmethods.net

Anomaly Detection

Using machine learning algorithms to automatically detect and surface insights relevant to Procurement. For example, unexpected changes in purchase prices for a commodity or from a specific supplier.



Procurement AI Software

According to Deloitte 45% of Chief Procurement Officers have used or piloted Artificial Intelligence Software in 2018. Here are 7 common areas where AI can be used across the procurement cycle.

Supplier Risk Management

Artificial intelligence can be used to monitor and identify potential risk positions across the supply chain. For example, in RiskMethods RiskIntelligence, big data methodologies are used to screen millions of different data sources and provide alerts in supply chain risk management software.

Solution provider: RiskMethods

AI in Purchasing Software

Artificial intelligence can be leveraged to automatically review and approve purchase orders. For example, in Tradeshift's platform a chatbot called Ada can be used to check the status of purchases or automatically approve virtual card payments.

Solution provider: Tradeshift

Accounts Payable Automation

Increasingly, machine learning is being used in accounts payable automation. Stampli is one example of AP automation software that uses machine learning to speed up payment workflows and detect fraud.

Solution provider: Stampli

AI Spend Analysis Software

In procurement spend analysis machine learning algorithms are widely used to improve and speed up a number of processes, including automatic spend classification and vendor matching. We'll go through this example in more detail in a separate chapter of this guide.

Solution provider: Sievo

New Supplier Identification

Big data techniques enable new ways to identify, manage and utilize supplier data across public and private databases. Platforms such as Tealbook use machine learning to enhance supplier discovery based on information gained, cleansed and enriched from the Internet.

Solution provider: Tealbook

AI in Strategic Sourcing

Artificial intelligence can also be used to manage and automate sourcing events. Keelvar's sourcing automation software uses machine learning for the recognition of bid sheets and has specialised category specific eSourcing bots such as raw materials and maintenance/repair.

Solution provider: Keelvar

Contract Management Software

AI has many potential use-cases in contract management. One very concrete example is natural language processing, which enables software like Seal Software to automatically scan and interpret lengthy and verbose legal documents for potential savings opportunities.

Solution provider: Seal Software

Training AI with Procurement Data

Most uses of artificial intelligence in business contexts require some human supervision. When you see implementations of AI in procurement, they are likely to involve supervised learning. In these cases, procurement experts are included to actively train machines to perform a specific task.

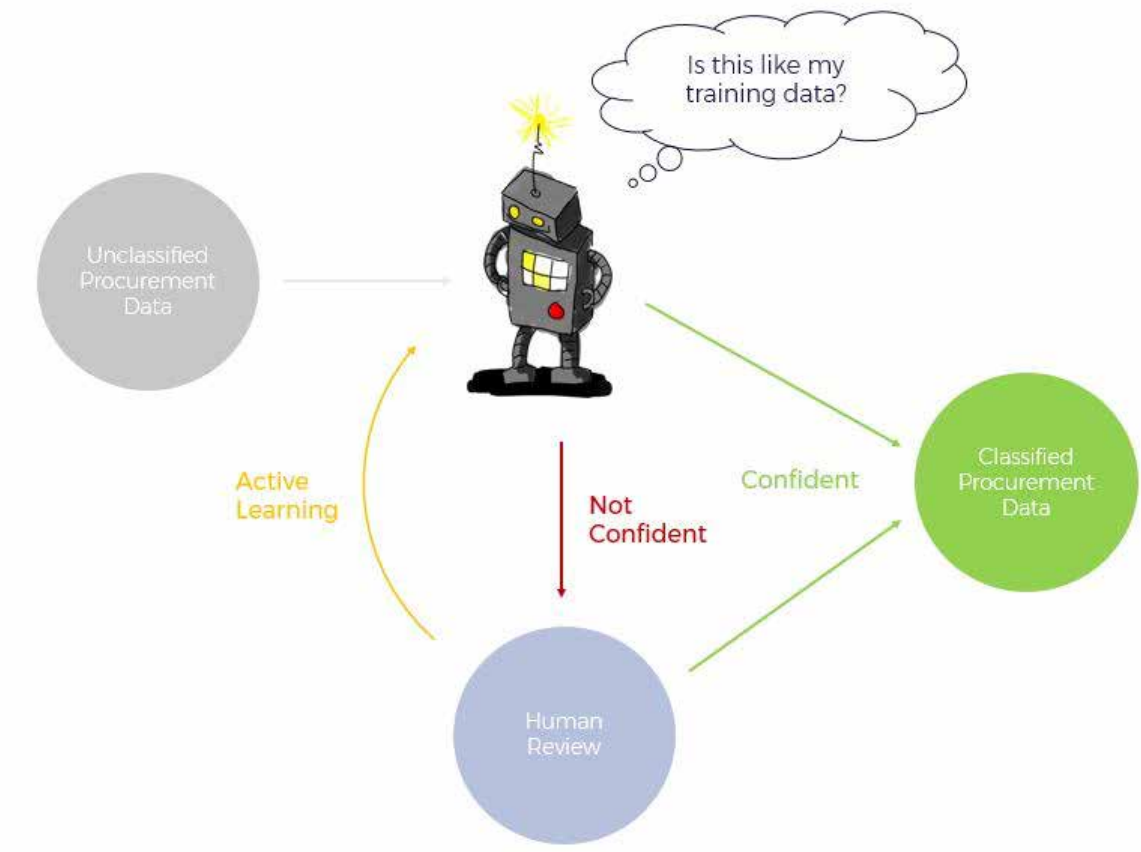
Here is how you could train AI with procurement data:

As a first step, a set of training data is given to an AI algorithm with a specific challenge. For example, it could be asked to observe how 100,000 invoices have been classified into different categories of spend.

With a clear goal and some training data in mind, you could then begin to give the AI algorithm unclassified Procurement data to classify based on the logic it has observed in the training data.

In cases where AI has high confidence it can classify data correctly, the data would be automatically categorized without human input.
In cases where AI does not have high confidence, the classification decisions would be reviewed by Procurement experts. This process is sometimes called "human annotation."

With feedback from human reviews, Procurement Data would be both classified and utilized to actively teach the AI algorithm to classify future data.
Over time, the confidence of the AI would improve to automatically classify more data, while also increasing the quality of data classification based on the human input.



When you consider this training process from the point of view from a Procurement organization, consider what are the tasks at hand where you would have enough training data, a need to consistently process unclassified data and a concrete output that adds business value.

Let's look at a few scenarios where AI can help Procurement.

How AI Can Help in Procurement

AI thrives at solving complex problems involving large amounts of data but clearly defined measures of success. A recent study by Harvard Business Review and Deloitte explored the key areas where business executives expect to see the most success with AI. While each organization has its own challenges and opportunities, these can be the areas where AI can bring value to Procurement.

Key areas AI can support Procurement:

Make better decisions – artificial intelligence can provide timely analytics and data-driven insights to make better sourcing decisions.

Identify new opportunities – shifting through vast amounts of data, AI can uncover new savings or revenue opportunities.

Improve operations – artificial intelligence has the potential to streamline or align internal business operations, even in large organizations with many business units or geographic locations.

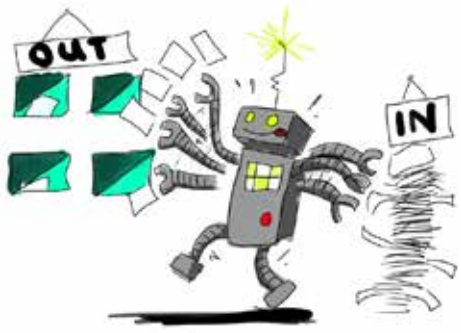
Automate manual tasks – AI can automate many time-consuming tasks, such as monthly processes, or Procurement performance reporting.

Free up time – by taking care of more routine tasks, AI can free up Procurement resources for more creative or strategic tasks like key supplier relationship management.

Capture or apply scarce knowledge – artificial intelligence can help Procurement organizations capture relevant new sources of data, for example, from external data sources like the Internet.

Identify new suppliers or markets – with access to vast amounts of external data, AI can help identify new suppliers or even new markets to enter.

Optimize supplier relationships – AI has the potential to make supplier relationship management more data-informed.

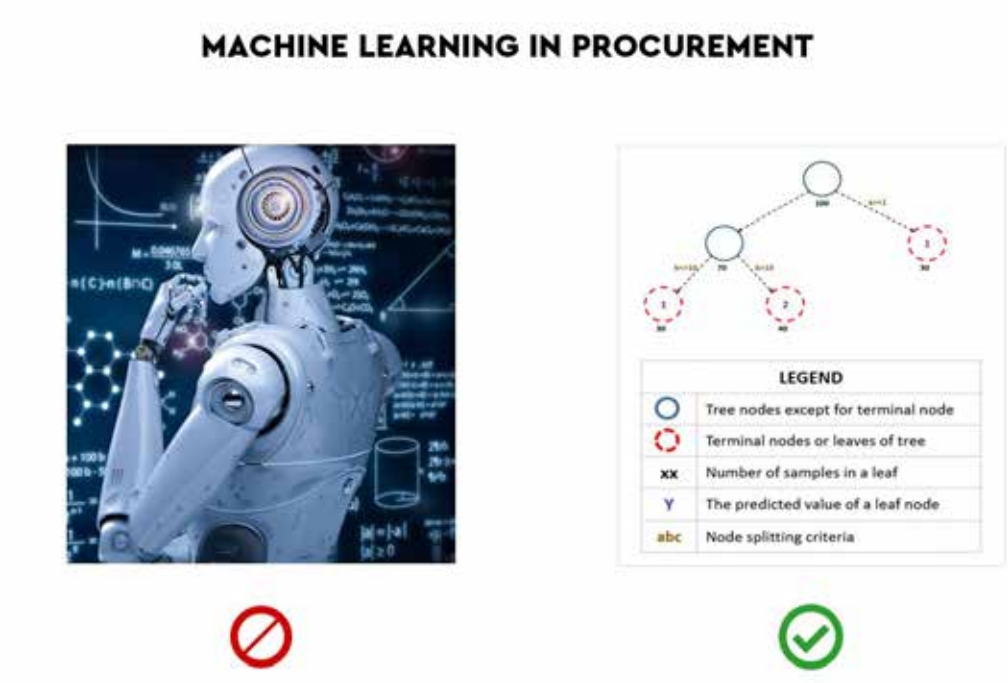


Machine Learning in Procurement

Machine learning (ML) is the subset of artificial intelligence(AI) with the most immediate applications within procurement. It is a natural successor to robotic process automation (RPA) in the evolution of automated or autonomous procurement processes.

At the same time, machine learning is one of the most misunderstood aspects of AI in procurement organizations. There is much confusion over the question "what is machine learning in procurement?" Some enthusiasts consider any examples of advanced statistical methods to be ML, while many software vendors portray images of human-like machines. It's time to dispel some myths by reviewing the core types of machine learning.

For procurement, machine learning is the application of self-learning automated statistics to solve defined challenges or improve operational efficiency. While RPA can is considered as automated statistics, it lacks the ability to learn and improve over time.



Machine learning is the application of self-learning automated statistics to solve defined challenges or improve operational efficiency.

Types of Machine Learning (from a Procurement Context)

Today, different types of ML are used within procurement processes, each requiring a varying degree of human intervention.

Supervised Learning: an algorithm is taught the patterns using past data, and then detects them automatically in new data. Supervision comes in the form of correct answers that humans provide to train the algorithm to seek out patterns in data.

Commonly used within procurement in areas such as spend classification.

Unsupervised Learning: the algorithm is programmed to detect new and interesting patterns in completely new data. Without supervision, the algorithm is not expected to surface specific correct answers instead it looks for logical patterns within raw data. Rarely used within critical procurement functions.

Reinforcement Learning: the algorithm decides how to act in certain situations, and the behavior is rewarded or punished depending on the consequences. Largely theoretical in the procurement context.

Deep Learning: an advanced class of machine learning inspired by the human brain where artificial neural networks progressively improve their ability to perform a task. Emerging opportunity in procurement functions.

Machine learning algorithms can be taught the difference between dogs, muffins and mops through supervised learning

Machine Learning Spend Analysis and Classification

Machine learning is already widely used across data-intensive processes such as procurement analytics. Let's deep-dive how machine learning is used in spend analytics, and specifically to tackle the spend classification challenge.

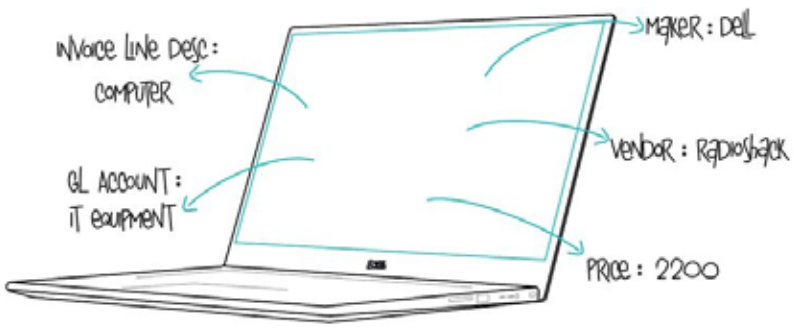
The Problem with Spend Classification

How to classify spend into procurement categories is one of the oldest challenges in procurement spend analytics and one of the first applications where artificial intelligence is broadly utilized today.

A problem many Procurement organizations face is the need to categorize millions of unique transactions into procurement categories based on data coming from invoices, purchase orders or other data sources. Well meaning Procurement organizations create complex hierarchies of categories and sub-categories, but find it difficult to maintain a sufficiently high data quality or speed to categorize new data. In the past, it was common that procurement spend was analyzed once a year or each quarter, while high-performing Procurement organizations today rely on nearly real-time data updates to meet the needs of business.

Another key challenge is that the amount of data available is growing across different source systems and there is an increasing challenge to connect heterogeneous sources of data. Today's Procurement organization may need to bring together spend data from across a number of enterprise planning systems (ERPs), purchase-to-pay solutions or other finance-related software. Each source system may contain only some relevant data points, and there is a need to connect disparate spend data into one hierarchy.

THE SPEND CLASSIFICATION CHALLENGE IN PROCUREMENT



For example, a new Dell computer may be labelled as IT equipment in the general ledger, while the invoice line description provides additional detail distinguishing it as a laptop computer. The purchase order for this item may even have a different description, referring to vendor or maker specific data-points. While all these data sources refer to the same item, it requires intelligence to make a correct classification.

AI Procurement Spend Classification

While different aspects of AI have the potential to solve or reduce the spend classification challenge, most software solutions today involve some form of supervised machine learning. Let's go through a concrete example of machine learning powered spend classification from Sievo's spend analytics in a number of concrete use cases:

As a starting point, machine learning algorithms can automatically classify new spend data into procurement taxonomies.

The software can also provide suggestions for category experts through a classification tool (see screenshot below).

In addition, the machine learning powered AI-classifier can give a confidence level from 0 to 1 for each classification suggestion. A low confidence is closer to zero while a larger number depicts a higher confidence.

Machine learning can also go beyond new spend classification. It can spot errors made in previous rule-based classifications by human category experts.

A human category expert can review or validate AI-classified data and provide valuable training input for future classifications.

Transactions

Spend	*AI suggestion*	AI confidence	Material	Vendor	Account
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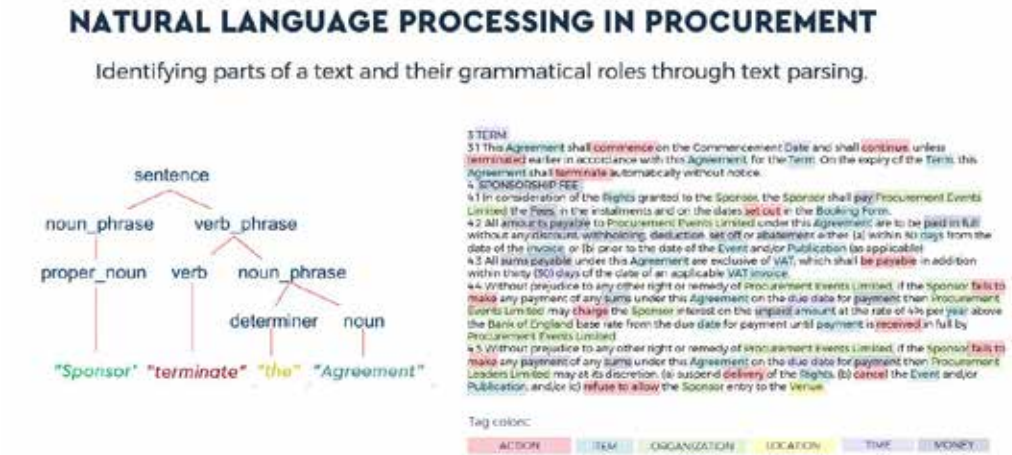
Natural Language Processing in Procurement

Natural language processing (NLP) is the branch of artificial intelligence focused on understanding, interpreting and manipulating human language. For procurement, NLP can uncover insights from existing data or enable new ways to streamline time-consuming processes. Let's go through some concrete examples.



Data contained in legal contracts and documents can be parsed (interpreted) by AI for procurement relevant information.

NLP in Contract Management

Legal contracts contain a lot of valuable information for procurement, for example, on termination dates, payment terms and re-negotiation rights. Historically, this information has not been readily accessible to procurement teams because contracts have been written in contractual terms and stored offline or on shared online folders where the data contained in contracts has not been readily available. Natural language processing has enabled procurement to mine contracts for valuable data through a method called text parsing. Contract management software can utilize parsing algorithms to efficiently scan and interpret even large amounts of contracts for critical information. Taking this even further, optical character recognition (OCR) is an AI-enabled approach that interprets and identifies text automatically from any images, including photos of previously un-digitized scanned contracts.

Word Embedding in Invoice Descriptions

AI software and algorithms are much better at interpreting numbers than human language. A simple analogy is that computers think in terms of binary systems (ones and zeroes) while humans think in terms of words. Word embedding is a form of NLP where words and phrases in vocabulary are mapped in similarity and relation to other words. Word embedding can be useful for procurement in the analysis of text fields in purchase orders, identifying groups of purchased items that come within a similar category or sub-category.

Natural Language Generation in Chat Bots

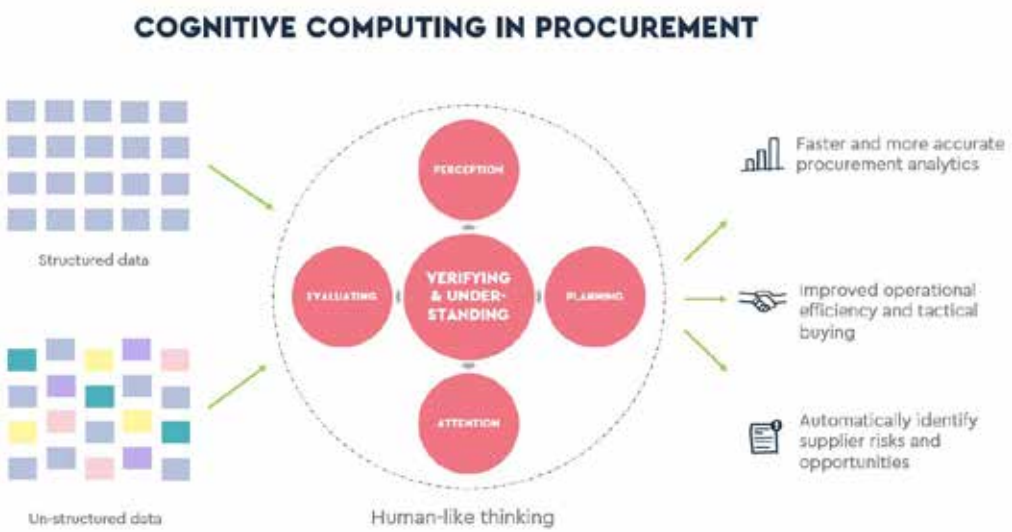
Chat bots and personal assistants are among the most talked about applications of AI that rely on natural language generation (NLG). These take NLP further by first interpreting human input and then giving a response in written narrative.
Voice-based assistant like Siri, Alexa or Google Assistant are already widely used in consumer applications, but NLG is currently limited within procurement to pre-configured chat bots or virtual assistants that automate very limited tasks.

Cognitive Procurement

With all-new technologies come new terms and definitions. In Procurement, one of the most talked-about new buzzwords in recent years has been "cognitive procurement."

What is Cognitive Procurement?

Cognitive procurement is the process where self-learning AI techniques such as automated data mining, machine learning, pattern recognition and NLP are used in a Procurement context to mimic human intelligence. The phrase originates from an emerging field of advanced computer science termed "cognitive computing."



Cognitive Computing

Cognitive Computing (CC) refers to any hardware or software that mimics the functioning of the human brain and helps improve decision-making. It models how the human brain senses, reasons and response to stimulation to solve specific tasks or challenges.

Cognitive Analytics

One way in which cognitive computing can relate to Procurement is through cognitive analytics (CA). CA is a new approach to generate insights from large amounts of structured or unstructured data through mimicking a human brain's ability to interpret patterns and draw conclusions from data. While many procurement analytics challenges may be solved by cognitive analytics, not every AI-assisted analytics solution involves cognitive solutions.

Cognitive Sourcing

Another way that cognitive computer can support Procurement is through assisting sourcing processes. Cognitive sourcing can help buyers and Procurement teams to identify new opportunities or automate non-strategic sourcing activities. Sourcing assistants such as chatbots can be considered examples of cognitive sourcing.

Challenges with Cognitive Procurement

The field of cognitive computing is relatively new, so it should be approached with caution. As of 2019, there is not yet a broad consensus on core definitions and what constitutes "cognitive" processes in a business context. At the same time, many software solutions are being offered with the promise of embedded human-like intelligence. While technology is developing fast, it is recommended to validate assumptions within cognitive procurement with internal or external information systems experts.

AI Best Practices for Procurement

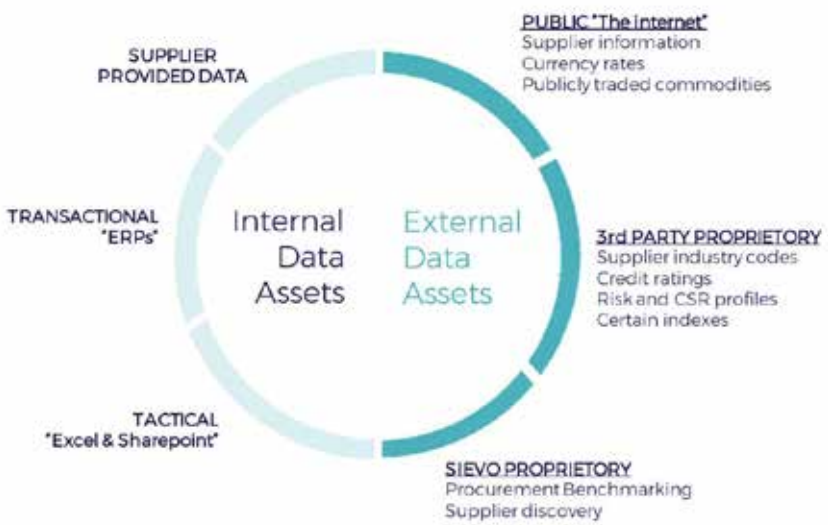
Even the longest journeys start with small steps. We've gathered a number of proven best practices for Procurement executives to start a journey into utilizing artificial intelligence. More best practices can be found in our 11-page Procurement AI Game Plan.

Start with boring problems

To start with AI, don't look for miraculous new solutions to change the way you run your Procurement operations. Don't think of AI like magical new technology. Instead, think of AI from the business process point of view. Consider the challenging but boring business operations that already take time and resources to manage. The most immediate value of AI will not come from new applications, but from embedding technology into existing processes – for example, improving your existing spend analysis or contract management processes.

Capture all possible data

Another general rule of thumb is to capture as much data relevant to Procurement as you can before you know how to use it. Don't wait for your data quality to be perfect. Instead, assume that AI technologies can help you interpret and improve historic data quality over time. The key is to collect more data for AI to interpret. The more data you give AI to train on, the better results you're likely to get.



Give AI clear challenges

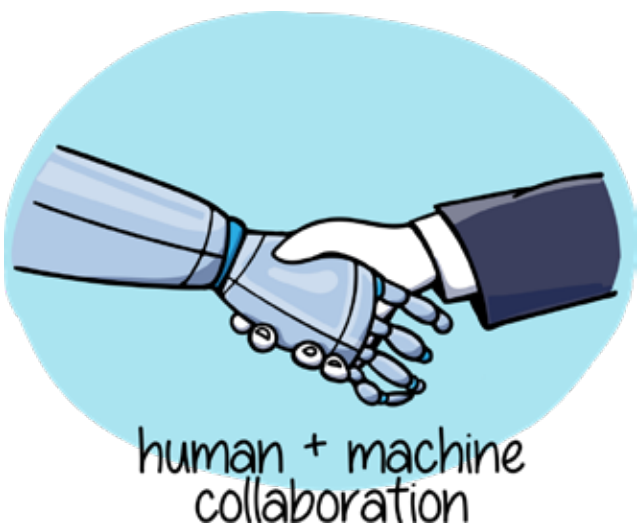
In its current state, AI and machine learning are very good at narrow use-cases. You can utilize machine learning to categorize Procurement costs based on invoice line items, but you're not likely to have AI take over complex supplier negotiations. Evaluate which routine tasks require a lot of your procurement team's time but have clear outcomes on performance.

Be open to experiment

While AI has a lot of potentials to improve Procurement's performance over time, there are still many uncertainties. Be open to experiment. Consider giving emerging AI technology specialists challenges and training samples of your data. Allow for mistakes and learning, and focus on the expected business benefits. Recognize also that technology is developing at a fast pace, so failed experiments of tomorrow can be possible with the new AI methods of today.

Enable Human + Machine Collaboration

Finally, remember that all implementations of AI in Procurement will require active guidance and support from Procurement experts. Plan for human and machine collaboration, where your Procurement team's expertise is augmented, not replaced, by artificial intelligence. Be the champion of change to make the best use of both human and machine intelligence.



Human and machine collaboration

Create an AI Game Plan

If you've read through this full guide you're well on your way to mastering AI in procurement. Congratulations!

Still hungry to learn more?

In the video below you can listen to the podcast we created in collaboration with Art of Procurement, the #1 podcast for procurement leaders.

On the podcast recording you'll hear the host of Art of Procurement Philip Ideson discuss with Sievo's co-founder Sammeli Sammalkorpi how you can establish your procurement AI game plan.

FAQ: AI in Procurement

To compliment the AI in Procurement game plan podcast we created a 14-page workbook answering some of the most frequently asked questions by procurement practitioners.

FAQ: AI in Procurement

To compliment the AI in Procurement game plan podcast we created a 14-page workbook answering some of the most frequently asked questions by procurement practitioners.

Popular questions about artificial intelligence among procurement professionals include the following.

Should organizations drop AI into existing processes or change their processes to accommodate AI?

By and large AI can be applied to existing processes, so it's not like you need to fix something before you can start to capture the benefits from AI. At the same time if there's one advice on how to prepare yourself to leveraging AI, now and three to five years' time, try to capture as much data as you can, even if you can't process all of that data right now. When you have mass data amounts accessible you may be able to benefit from them in surprising ways in the future. To prepare to benefit from AI capture data even though you don't know how to use it

Is AI in procurement only for larger organizations, or is there a case for smaller businesses, too?

Think of machine learning as just a new form of software. Software today is being used widely across all types of businesses, big and small. If you are Deutsche Telekom or Walmart you may have very different software needs than if you are a small business. If you are an SME you probably wouldn't go about building your own machine learning application just like you probably wouldn't code your own custom software. You would just look for the right software providers to suit your needs and these are already starting to emerge.

Is there a Forrester Wave or Gartner's Magic Quadrant for AI in Procurement?

There is currently no resource like this because the applications of AI are so broad. In procurement applications, most of the value of AI today is embedded into existing solutions, for example existing contract management or procurement analytics solutions. AI is more of an enabler than an application itself, although many people seem to be looking for a new concrete application.

What does governance look like? How do you govern machine learning?

There are three kinds of human machine collaboration models when it comes to AI.

The first is called "human in the loop", which basically means that whatever the machine does there's always a human to see the result and approve, disapprove and so forth. This is a good approach if those decisions are super critical or if there's a rather small number of those decisions to be made and they are high value.

Then there's the "human on-the-loop" which means that the machine does the stuff on its own, but there's a human supervising the process, which really works well when you have a routine task.

The third option is "human out-of-loop" which let's the machine learning run and go rogue and there isn't a way for you to intervene. An example of human out-of-loop is financial markets and the high frequency trading. In this case, speed is of essence, which requires you to let the machine do the decisions because humans are just too slow to intervene.

Whenever you apply machine learning you should think of what sort of model you want to apply. "Human in-the-loop", I will change or approve each decision, "human on-the-loop", human actively supervises, or "human out-of-loop, I let the machine run and trust it to do its job.

If machine learning relies on humans for training data, will it be biased?

AI is only as good or bad as the behavior we show the AI in our training data. For some applications you can really take out the human bias. For example, you can train a machine to objectively distinguish between benign and malign skin conditions like cancers. Then there are other applications where it's super hard to stay unbiased. More and more AI is used to process employee candidates, go through the CV's and applications. It's very difficult to remove human bias from this process. If recruiters or AI developers have a bias based on gender, ethnicity or something like that, all those biases could be coded into the process. To try and stay unbiased you need more than one source for your training data or alternatively a rigorous vetting process for bias.

Explore these questions and many more in the **free workbook** developed by Sievo and Art of Procurement. See it here: *http://hub.sievo.com/resources/procurement-ai/gameplan*

About the authors

This guide is created and regularly updated by a team of procurement AI enthusiasts at Sievo.

You can find out more about what we do in the video here: *https://www.youtube.com/watch?v=tBBxn_ZHIZY&feature=emb_title*

We'd love to hear what you think about this guide and how we can improve it in the future. You can find us on LinkedIn and Twitter or reach out to us through this website.

Sievo in brief

Sievo helps businesses turn procurement data into dollars. By consolidating all procurement related data under one platform, Sievo uncovers hidden value and provides insights for data-driven decisions. With AI-driven classification and data-driven external benchmarking, Sievo provides the leading procurement analytics solution powering procurement organizations worldwide.

If you would like to learn more about Sievo you can request a free 30-minute demonstration with one of our product specialists.