OCP SOLUTIONS

BIG DATA & AI

Leveraging AI & Big Data to drive Supply Chain management efficiency.

May 2023

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By Ayoub MAMDOUH
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Abstract

It is now more crucial than ever to comprehend and investigate the potential of Big Data Analytics and AI to enhance commercial operations, given the enormous increase in data at all supply chain stages. Companies are starting to understand the potential of Big Data and Artificial Intelligence (AI) to make better, quicker, and more informed decisions across a variety of industries. How does it affect the bottom line? What and how do they utilize technology?

This white paper examines how Big Data and Artificial Intelligence are being used in Supply Chain management across various industries. The goal is to present a succinct yet thorough account of the megatrends, the technologies involved, as well as their potential and implementation challenges. In this initial draft of the white paper, we seek to compile lessons learned from numerous industries that are pertinent to the work of OCP Group.

We will begin by discussing Big Data in terms of Supply Chains. Then we will reveal the bottlenecks that traditional systems experience, with examples of how data-driven processes powered by SCOR (Supply Chain for Operations Research) analysis can alleviate these problems. The advantages and difficulties of using each type of analysis method will then be discussed in detail. Finally, towards the end, we will present a plan for integrating Big Data and AI analytics into Supply Chains, highlighting the unique issues that must be solved for a successful adoption.

Summary

Editorial

"Jarvis's world is already ours"

By Ayoub MAMDOUH, Managing Director of OCP SOLUTIONS

Jarvis first helped Iron Man (Tony Stark) and the Avengers to save the world before becoming the artificial intelligence program that helps Facebook founder Mark Zuckerberg in his daily life. Edwin Jarvis, the butler who served billionaire Tony Stark, is the virtual equivalent of Jarvis, whose full name is Just A Rather Very Intelligent System. However, Jarvis is not content to simply oversee his "boss's" day-to-day activities. Instead, he manages all of his affairs, gets involved in maintaining the city's security, and connects Iron Man with the Avengers to coordinate their actions.

If Jarvis, this virtual voice that provides cues like the voice from the station announces the departure of the train, had not foreseen anomalies or malfunctions to come, the Avengers—superpowered, super-intelligent, super-strong, in other words, superheroes with supernatural powers—could have repeatedly lost face in front of the eyes of their numerous fans around the world. These are unfortunate circumstances, dangers that the Avengers could not have foreseen. Jarvis has only analyzed the data and taken the important information out of it.

Jarvis doesn't try to take the place of or compete with human or superhuman qualities. He enhances them by encouraging them on a better basis, one that is more trustworthy and that gives a more precise topographical description of the situation. The decision can be aided by Jarvis, who already does so by examining the Big Data he gathers. But most of the time, he is content to follow Tony Stark's instructions, who, depending on the situation and with or without consultation, makes the final decision.
Although the abilities of the Avengers are fantastical. Jarvis's are not, and they might be advantageous to Mr. Ahmed, our neighborhood banker. Mr. Ahmed reads his emails, prepares his files, sets priorities for his tasks, attends meetings, welcomes clients, and occasionally answers the phone when he gets to work in the morning. Before going home in the evening, he checks and closes the accounts of the few thousand clients of his agency. Given the sensitivity of the data Mr. Ahmed processes, he must be extremely watchful and alert at all times.

Furthermore, he must constantly be searching for fresh opportunities, especially in a market that is competitive and characterized by frequent, intense crises. After dark, Mr. Ahmed nods off while watching his preferred Avengers film. In his dream, Jarvis is waiting for him in his office the following day, having filtered his emails, prepared his interviews, and briefed him on recent trends. Mr. Ahmed's dream may come true because the data he gathers from his interviews and the transactions kept in the agency's information system both contain hazy indicators of what will occur tomorrow, in a week, in a month, or in a year.

These indicators include patterns in consumer spending, seasonal effects, unusual behavior, etc. To extract this predictive function, a significant amount of data must be analyzed, and the task appears challenging to complete. However, it is precisely this abundance of data that will enable Jarvis' algorithms to locate keywords in emails so that they can be properly filtered, to comprehend the new market segmentation so that customers can be ready for interviews and to locate outlier cases so that risks can be reduced. Because he can now concentrate more of his efforts on commercial prospecting and proactive risk management, Mr. Ahmed believes that his abilities have increased.

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Mr. Ahmeds exist in all professions. Human resource managers, for instance, can use their Jarvis to learn about new professions, new skills, and the locations of talent. In order to determine the need for training, upskilling, or reskilling, the gap between the organization's professions and new professions, and the geographic concentration of the desired talents, Jarvis could sift through all of this data. Based on this, the manager could create a strategy that was both realistic and in line with the company's actual reality. As a result, he would have greater analytical and strategic thinking skills for making wise decisions.

Finally, Jarvis is now readily accessible for some professions. As an illustration, consider how airplane pilots have relied on autopilots to carry out their flight plans for many years. Thus, the pilot controls the autopilot by setting the ceiling, altitude and other parameters while supervising the smooth operation of the flight. However, if the circumstances call for it, he will retake control. As a result, fuel consumption is reduced, and the pilot is more concerned with the safety and comfort of the passengers.

In fact, Jarvis has given the Avengers more superpowers through these virtual technologies, which come to life thanks to analytics, Big Data, or Artificial Intelligence, among other things. In the same way, it will enable us to witness the appearance of augmented researchers, supply chain managers, and other professions in real life!

“Making Informed Decisions”

By Mohammed Mahdi AKKOUH, Principal Modeling & Analytics at OCP SOLUTIONS
and Adnane MOULIM, Partner Modeling & Analytics at OCP SOLUTIONS

Big Data and AI are being used more and more in Supply Chains across several sectors in Africa and Morocco to save costs, boost productivity, and enable better decision-making. OCP Group must radically rethink how "data" is used in light of the exponential expansion in data flows, the development of cloud platforms, and significant advancements in AI and Machine Learning models. This is even more crucial in light of shifting market dynamics, remote employment, greater sustainability consciousness, and increasing customer expectations.

OCP is one of numerous major enterprises on the African continent with enormous data vaults that have little value. We think that the full potential of this data is still substantially untapped, despite some of it being used qualitatively or statistically to support decision-making. Thus, bias and uncertainty may show up at any point during the supply chain management process. This has a number of drawbacks, including poor forecasting and demand planning, inconsistent inventory assessments, a lack of flexibility at the distribution network level, and sensitivity to business interruptions.

Big Data Analytics has the power to make decision-making less dependent on human intuition by analyzing large amounts of data. Automatic learning enables sophisticated models to be trained directly on data, learning the fundamentals in the process. This enables models to learn for themselves over time, achieving levels of accuracy that improve as more data is collected. According to Gartner, by the year 2023, automatic learning and IA methods will be a key component of 25% of Supply Chain technology solutions worldwide. Businesses in the forefront of these trends have adopted a completely new mindset in order to maximize their investment returns. But why have so many other businesses around the world not experienced such a success?

We believe that three major challenges that create a high barrier to entry will ultimately restrict the overall influence of Big Data on Supply Chains. To gather and store the data, strong and flexible processes are required. To analyze and interpret the data, qualified abilities are required.

Finally, a paradigm shift among all involved stakeholders may be necessary to unleash the full potential of data analytics and provide the most value and, most importantly, the greatest positive influence on business and society.

What topics will this white paper focus on?

This whitepaper reviews advanced Big Data analytics and AI as applied to Supply Chain management across industries worldwide. The goal is to provide a concise yet comprehensive account of 1) megatrends, 2) the technologies involved, 3) their potential, and 4) challenges related to their implementation. Our aim in this whitepaper is to synthesize learnings from a broad spectrum of relevant industries, not restricted to OCP's Supply Chain.

In today's business environment, data has become a major factor in every company's operations. Big Data analytics and Artificial Intelligence are tools that companies are now using to improve their business decisions and make smarter decisions faster.

Supply Chains rely on data for the most efficient operation. In this article, we will explore how data is incorporated into Supply Chains, as well as how analytics can be used to address bottlenecks plaguing traditional Supply Chain systems. Next, we will review the different types of analytics methods used for Supply Chains, and present pros and challenges related to each method's implementation. Finally, we will share a roadmap on how Big Data analytics can be implemented in Supply Chains, as well as specific challenges that need to be addressed before successful adoption occurs.

Big Data in Supply Chains

What does "Big Data" mean?

Businesses are facing an increase in the amount of data they must analyze, and they need to be able to process this information quickly. Big Data is a term that describes extremely large volumes of structured and unstructured data that get created on a day-to-day basis during business activities. Big Data may be visualized using dashboards or analyzed computationally to reveal patterns, trends, and associations between the various entities involved in a Supply Chain.

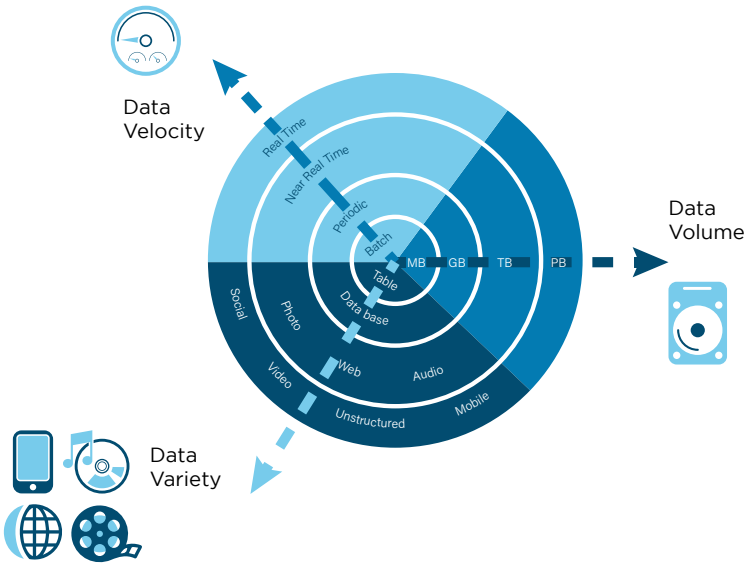


Figure 1. Growth of data's volume, velocity and variety.

Big Data applied to Supply Chain

Supply Chain data comes from many sources, including ERP systems that integrate and structure information related to demand, sales, capacity and more. Barcodes and RFID (Radio Frequency Identification) data can come from inventory positioning and warehousing. Sensors and cameras record streams of data as time series or images which sometimes come in real-time. They also need access to archives on past business operations in large portions. Other datasets can come from internet-powered apps and social networks.

Source	Data type	Data size	Growth	Structure of data	Data quality	Ownership
ERP systems	Demand, sales, capacity, SC plans	Large	↗	Structured	Medium	Private
Barcode/ RFID scans	Location, time, ID	Large	↗	Structured	High	Private
Sensors/ cameras	Quality, humidity, temperature, images, status of parts	Large	↑	Structured and unstructured	High	Private
Archives	Financial statistics, price data, weather data	Medium	↗	Structured	Medium/high	Public and private
Internet	Hits, click streams, startistics, comments	Very large	↑	Unstructured	Low/medium	Public and private
Social networking	Preferences, text, developments	Very large	↑	Unstructured	Low	Public and private

Figure 2. Big Supply Chain data may come from different sources (not exhaustive).

The six "Vs" of Big Data

It's common to characterize Big Data using the 6Vs; volume, variety, velocity, variability, veracity and value.

Volume: What are the scale of the data? 1000s and millions of rows of data?

Volume is how much data is stored on a computer. Big Data is when you can capture, store, and transmit more data than ever before.

Velocity: How fast is the data coming into this system? In minutes/hours, days or weeks?

Velocity is how rapidly data is created.

Variety: Is there a range of verticals or industries the data comes from? Financial, healthcare, education, etc.)

Variety refers to the range of content in the data set. Big Data is not just about volume and size but also the type of data being collected and stored.

Variability:

Variability refers to the fact that every new data generated includes more information than was available in the previous one. There are multiple forms of Big Data, and each has its own specific structure and rule.

Veracity: Can the data be trusted? Is it accurate?

Veracity is a measure of confidence in a given dataset and it reflects our ability to make reliable interferences from said dataset.

Value: How valuable is the data across different industries?

Value is what an organization derives from its data analytics. This value comes from how easily we can get the data into the hands of decision makers and other critical stakeholders.

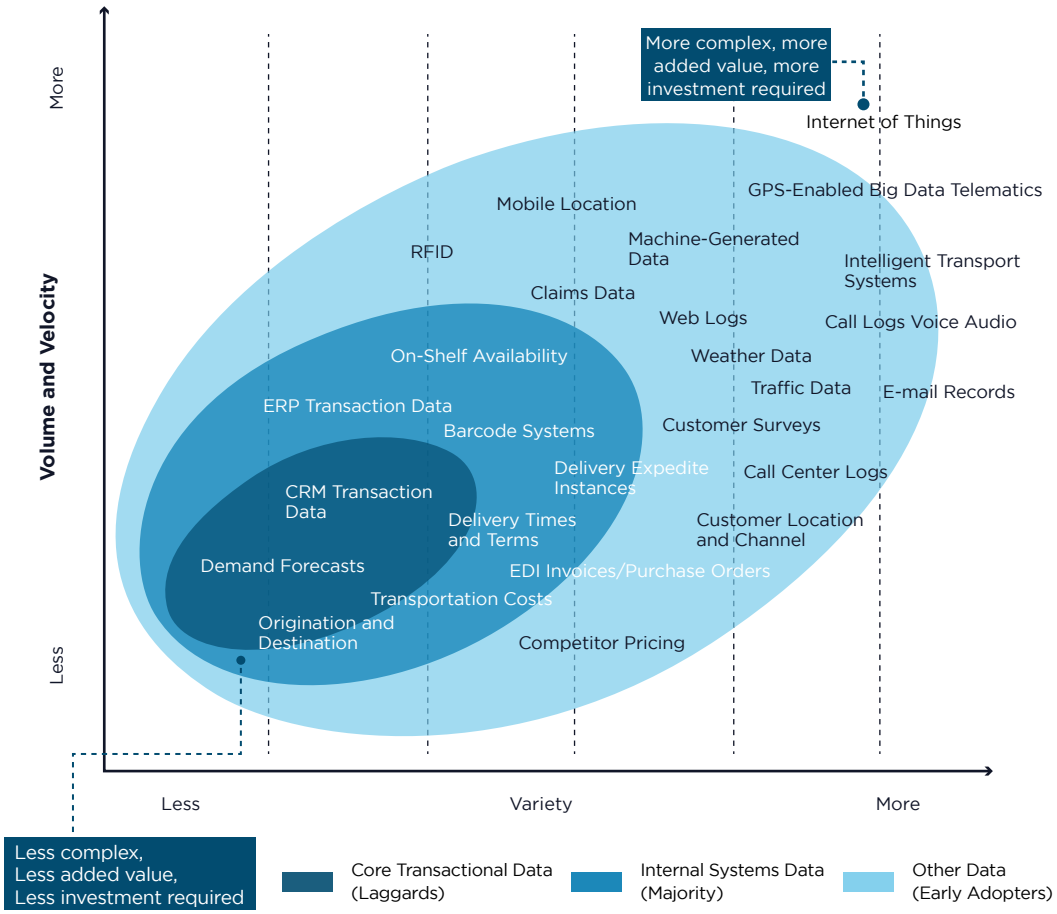


Figure 3. Data volume and velocity vs. variety in a Supply Chain.

Before Big Data can be used to solve business problems, it must go through a series of stages. First, proper collection mechanisms are needed to ensure data acquisition meets specific business needs. For example, some companies collect data that is motivated by a specific business need; other times, it is part of a broader company strategy. Next, data must be stored in an appropriate format so that it can be analyzed later on. Essentially, the cloud provides elasticity in compute requirements as well as flexibility in spin-up of resources. Intensive efforts are then required to curate and clean up Big Data so that it can be visualized or trained for machine learning purposes.

Figure 4. The different stages involved in Big Data value chain.

7 Legacy Supply Chain red flags

Supply Chain is a complex management field, with numerous challenges.

End-to-End visibility

End-to-end visibility is lacking; there is no common view across all businesses and channels.

Inventory management

Inventory management is important because it helps businesses avoid having too much stock or being forced to pay for excess inventory.

Freight Transportation

Freight transportation networks are not flexible enough to meet the changing needs of customers; tracking freight deliveries can be difficult for customers as well.

Risks & Vulnerabilities

Risk management becomes harder because it requires frequent reviews of stock levels, causing frequent stock-outs or excess inventory, in turn increasing inventory costs. (e.g. the covid-19 effect).

Demand planning

Demand planning is also affected by production line imbalance and suboptimal batch sizes, with companies sometimes overproducing or underproducing their output assets at the expense of long-term profitability or sustainability.

Knowledge management

Knowledge management presents its own challenges with large unorganized datasets sitting in without extracted value representing a big lost opportunity for business optimization.

Sustainability awareness

Sustainability awareness needs proper monitoring of further target variables in order to take them into account when performing optimizations

What can Big Data and AI do for Supply Chain?

In summary Big Data and Artificial Intelligence can be used to better match supply and demand for goods. These technologies can make it easier for companies to make faster, cheaper, and more-informed decisions across the information, product, and money flows of a business. In practice, this can influence the bottom line by reducing costs and enhancing service levels. Below are some key details:

Gain a return on investment (ROI)

A recent study by Gartner found that companies who use analytics in their supply chains are usually able to achieve high returns on their investment. However, those who don't have this capability usually struggle.

Improve transparency of operations

A comprehensive dashboard for managing inventory, logistics and Supply Chain KPIs provides a complete view of ongoing activities and allows the company's top management to easily find issues.

Better understand risks

By identifying patterns and trends throughout the Supply Chain, the risks can be accurately predicted.

Increase planning accuracy

A dynamic planning environment that factors in historical trends, upcoming orders, lead times, and many relevant features can help derive more accurate forecasts from advanced AI models.

Make data a corporate asset

Allows members of the organization to access, consolidate, and analyze data from a central database that can be used for a variety of business needs.

Enhance market responsiveness

Displays the ability to track data from internal and external sources, allowing companies to adjust business strategy quickly.

Be more customer centric

By understanding several characteristics about customers, it becomes possible to proactively understand customers' needs and highlights that better meet their highest expectations.

In addition, advanced AI and ML algorithms are being used in Supply Chains to solve a variety of business problems.

- Anomaly detection
- Fraud prevention
- Demand forecast
- Dynamic route optimization
- Delivery prediction
- End-to-end visibility
- Real-time tracking
- Cost Optimization
- Reducing manual work
- Intelligente decision making
- Scheduling maintenance
- Supplier relationship management
- Detecting issues
- Optimized procurement management
- Streamlined inventory management
- Enhanced customer service

Figure 5. Applications of ML in Supply Chains.

Sneak peek into the evolution timeline of Big Data & AI in Supply Chains

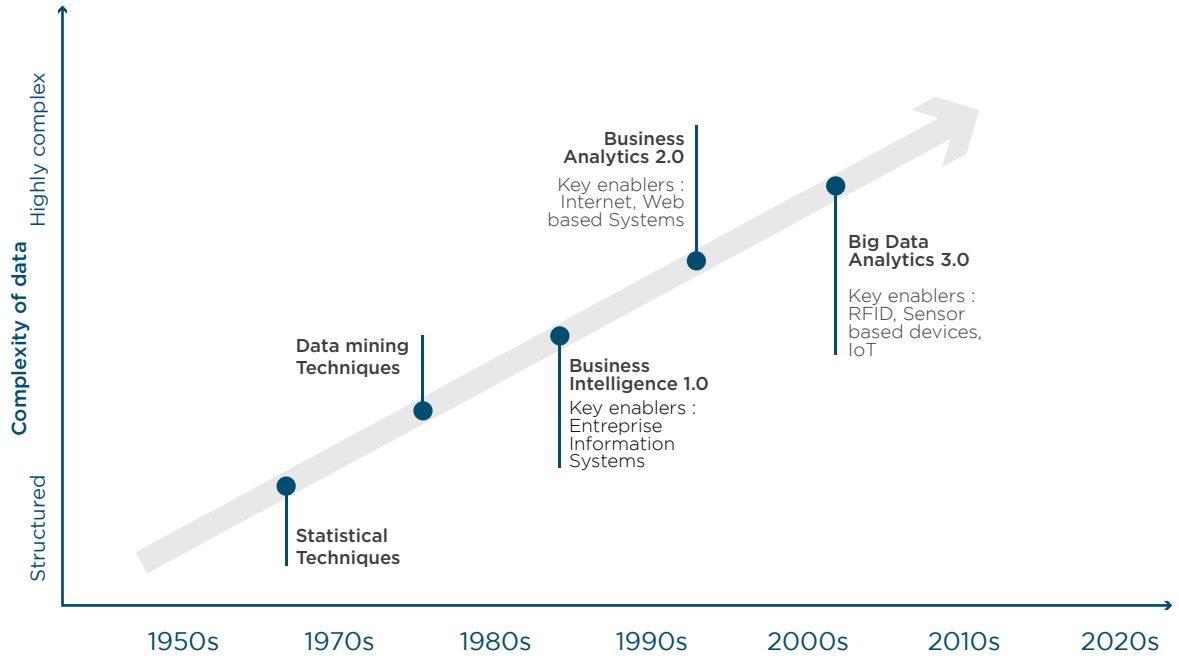


Figure 6. Evolution of Big Data analytics in Supply Chains.

In the pre-1980s era, new statistical and data mining techniques were developed that allowed more quantitative examination of data. The use of ERP systems emerged as a key development in the 1990s to allow companies to better structure and consolidate their Supply Chains.The data that we gather is getting bigger and more complex with each passing year, because of the internet and web-based applications that are part of our everyday lives.
Since the 1990s, the amount of data being generated has increased significantly. In addition to the complexity and size of data, this has also been exacerbated by the rise of the internet and web-based applications in the 2000s, which have required a fundamental rethinking of infrastructures and best practices used in the process of extracting value from data.
Along with the use of sensor and RFID technologies in Supply Chains, advancements in data storage infrastructures and training of machine learning/Artificial Intelligence technologies have created new opportunities for cognitive and AI-based technologies.

A framework for Supply Chain end-to-end analytics

Since Supply Chain operations involve a large number of entities, a relevant question is which stages can be most effectively analyzed by big data analytics?
The Supply Chain operations reference (SCOR) model, developed by Supply Chain Council (www.supply-chain.org), provides a good framework for classifying the analytics applications in Supply Chain management.

SCOR Domain	Source	Make	Deliver	Return
Activities	- Order and receive materials and products	- Schedule and manufacture, repair, or recycle materials ans products	- Receive, schedule, pick, pack and ship orders	- Request, approve, and determine disposal products and assets
Strategic (time frame: years)	- Strategic sourcing - Supply Chain mapping	- Location of plants - Product line mix at plants	- Location of distribution centers - Fleet planning	- Location of return centers
Tactical (time frame: months)	- Tactical sourcing - Supply Chain contracts	- Product line rationalization - Sales and operations planning	- Transportation and distribution planning - Inventory policies at locations	- Reverse distribution plan
Operational (time frame: days)	- Inventory replenshiment	- Workforce scheduling - Order tracking, scheduling	- Vehicle routing	- Vehicle routing (for returns collection)
Plan	Demand forecasting (long term, mid term, short term)			

Figure 7. SCOR model and examples of decisions at three levels.

The SCOR model outlines four activity domains: source, make, deliver, and return. A fifth domain—plan—underpins all four of them. Demand forecasting is a key input at all time period for Supply Chain planning; long-term forecasting involves years and months of planning, while shorter-term forecasting involves days and weeks. The table above illustrates different processes that can be supported by analytics in each of the four domains. These decisions are further classified into strategic, tactical, and operational according to their time period.

Forecasting Supply Chain analytics at a glance

Descriptive analytics

By answering the question **“what is happening?”**, Supply Chain mapping provides stakeholders with tools to make adjustments to delivery schedules and other functions, place replenishment orders, place emergency orders, change transportation modes, and so forth.

Diagnosis analytics

Diagnosis analytics is an advanced type of analytics that seeks to answer the question **“why did it happen?”** It is a logical next step after descriptive analytics, which only provides descriptive information about what happened; diagnosis analytics seeks to explain the cause behind each event in depth.

Predictive analytics

Answering the question **"what will happen? "** is a key role of demand forecasting. Demand forecasts derived from past data can help an organization understand the most likely outcome, future possible scenarios, and their business implications. These insights can also allow organizations to project risks and mitigate disruptions.

Prescriptive analytics

Answers the question of **"What should happen?"** Prescriptive analytics is a natural progression of the three previous categories in that it provides recommendations on business decisions to suit multiple predicted outcomes. The accuracy of prescriptive analytics is challenged by more uncertainty in predictions, which leads to the next category.

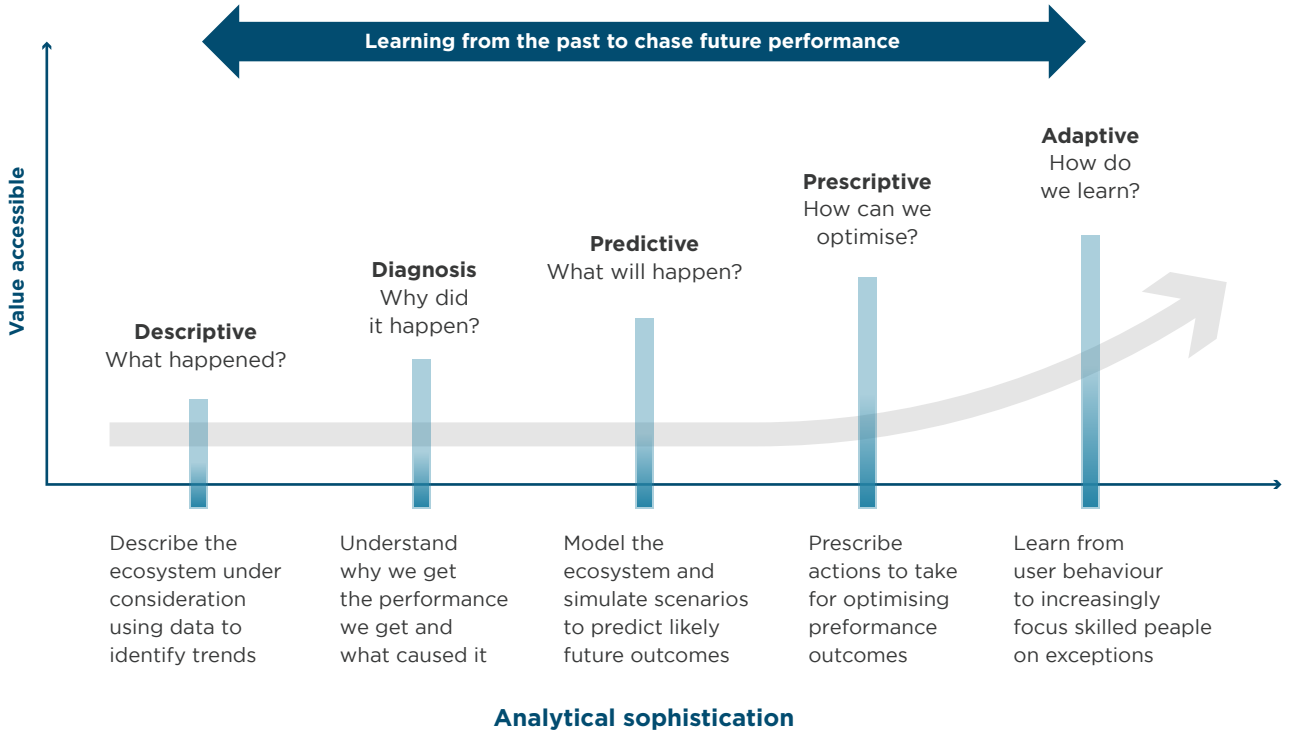


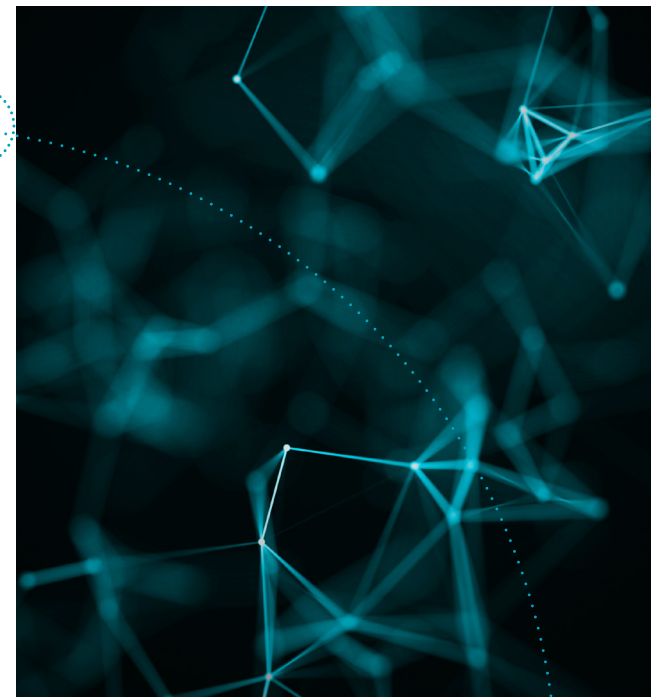
Figure 8. Types of analytics sorted by value and difficulty.

Taxonomy of ML methods

Machine Learning algorithms allow computer models to analyze data, derive insights and learn mappings between inputs and outputs. These models can then take actions in dynamic environments.

Unsupervised Learning

Unsupervised learning algorithms learn patterns in data without having to explicitly label the data. They're used to model the underlying structure of data and to learn more about the data itself. Unsupervised learning problems can be grouped into clustering and association problems; they have a direct tie to descriptive analytics.



Supervised Learning

A supervised learning problem is a Machine Learning task in which you have input variables (x) and an output variable (Y). You use an algorithm to learn the mapping function from the input to the output. Regression problems are used in the majority of practical Machine Learning applications, where you want to predict values for new inputs given values for old ones. Classification problems use statistical techniques for categorizing data into groups based on similarities between some attributes and an output variable.

Reinforcement Learning

Reinforcement learning is an umbrella term for a class of algorithms in which an agent operates in a dynamic environment and must learn to operate using feedback. Unlike supervised learning, which uses target values that remain constant over time, reinforcement learning has direct ties with prescriptive analytics and recommender systems.

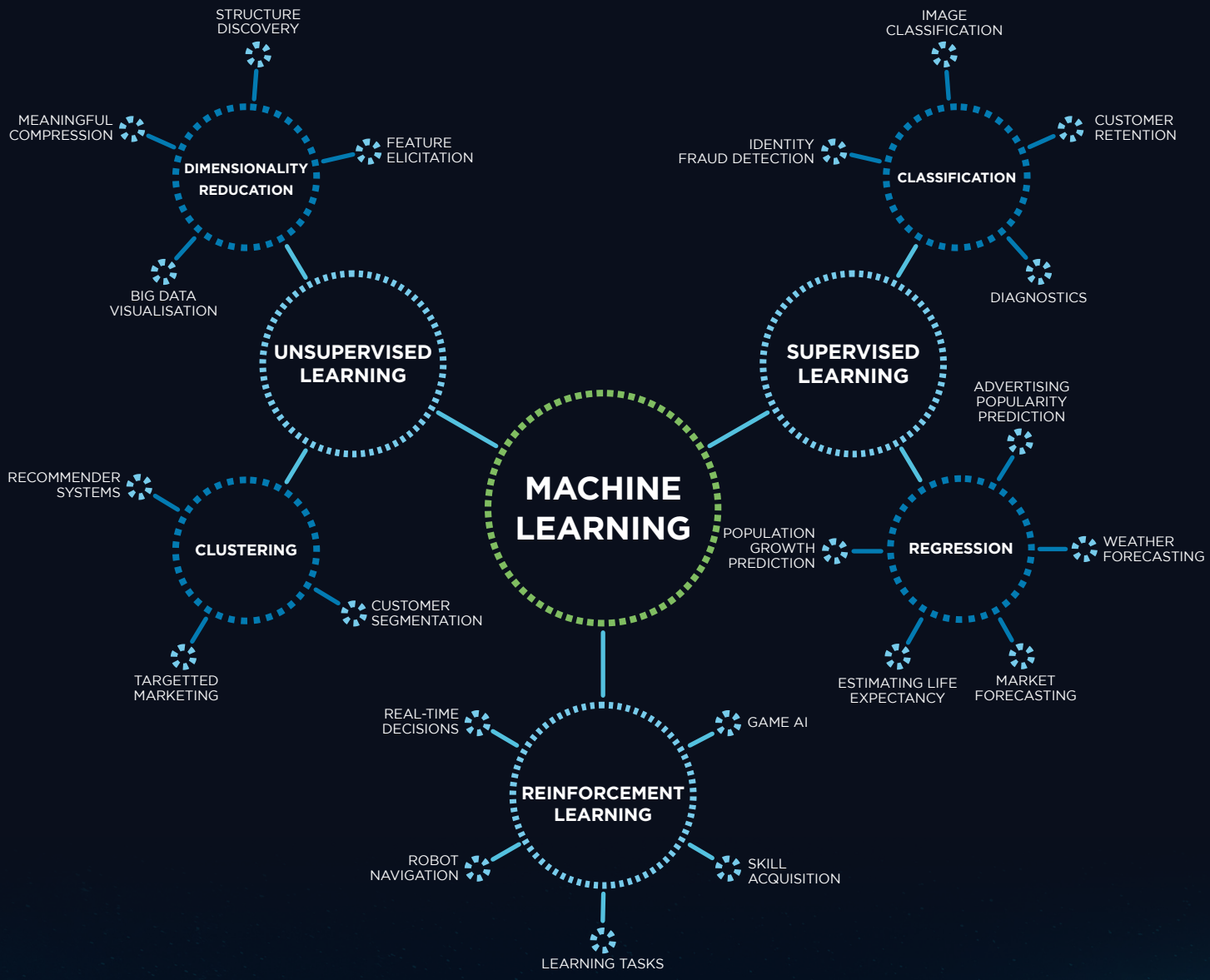


Figure 9. Taxonomy of Machine Learning methods.

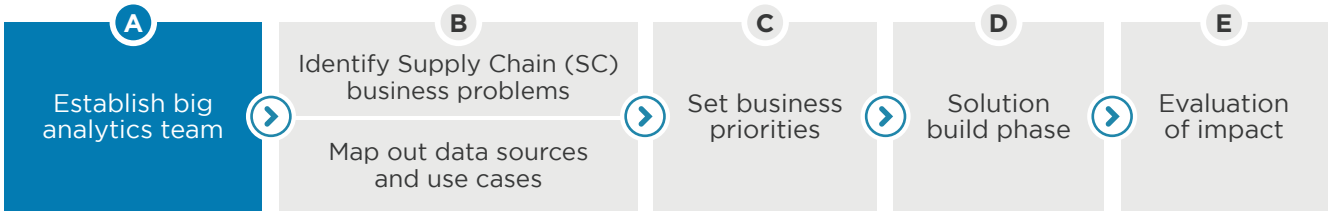
5 Steps to unlock Supply Chain analytics & AI potential

Build a dedicated team

A company can harness the full potential of Supply Chain analytics by forming a dedicated multifunctional team that takes full ownership of all matters related to Big Data and AI in the company. This group should have the right balance in skills between data science, IT and Supply Chain expertise. Its members will also undertake training Supply Chain functions to become more data-savvy.

Identify business problems and relevant data sources

Businesses need to examine their existing Supply Chains to identify the biggest problems and gaps in how they operate. They must then analyze these problems with business leaders, who can help them find solutions. Once these solutions are identified, businesses should collect data from different sources to make analysis easier.



What	- Identify data science skills needed - Refine program approach and hypothesis - Appoint business participants - Link roles to projects/priorities - Defing evaluation framework	- Map out the business problems - Link problems to processes and responsible roles - Brainstorm with functional owners - Set up project charter and team - Map out data sources - Review competitor's approach - Detect external use cases	- Agree on initial shortlist - Analyze impact potential • Cost • Capital • Service • Strategic advantage	- Access new data sources - Start data capture if source does not exist - Build analytical tools - Embed in business process - Solicit user feedback	- Review impact of use cases - Implement use cases at scale, or stop - Define potential next steps for use cases - Define additional impact potential of evolution - Review brand new ideas
Who	- Head of Supply Chain - SC HR function - CIO (review)	- Head of SC - Functional SC leads - SC leadership team - Need of data scientists	- Head of SC - Functional leaders	- Big analytics team - Functional leaders (review)	- SC leadership team - Big analytics team - CIO
Duration	~2-3 months	~2 weeks	~2 weeks	Weeks-months	~1 weeks (quarterly review)

Figure 10. Roadmap to capture big analytics potential.

Set business priorities

To determine the most important data-related issues, the team will need to consider both the cost and difficulty of getting data and the strategic importance of each issue. By making very detailed predictions at this stage, they can narrow down a list of priorities for their project.

Develop, train, test, and optimize models

Companies typically use a variety of methods to train and test machine learning models. They can collect new data and add new sources, or they can test their models on the same data that they used for training. Feedback sessions with Supply Chain functions can help make sure that the models perform well on new inputs, i.e., data not seen during training. Some companies may even use "hackathons" to develop initial prototypes for quick feasibility assessment. Iterations with customers will help fine-tune and improve solutions, or pivot them in a new direction.

Assess the impact

After the implementation cycle, it is important to assess whether the solution has achieved its expected outcome. Stakeholders need to decide whether to continue with the project, or put it on hold until there is a clearer value proposition. In some cases, stakeholders may decide that they do not have enough resources to invest in the project at this time and should move on to other ideas.

Three roadblocks to successful adoption

To fully harness the benefits of Big Data and Artificial Intelligence, organizations must develop a strategy for implementing analytics methods. Many companies struggle with the process of implementing these tools in their Supply Chains. OCP SOLUTIONS sees three major challenges that face the successful adoption of Big Data analytics and AI in Supply Chains.

Capabilities are needed to capture and analyze data

To build Supply Chain analytics, many organizations have a hard time finding the large amounts of data necessary. Furthermore, this information needs to be stored in one central database, which requires reliable integrations and coordination among all entities involved.

Skilled talent needed to build and interpret analytics

The shortage of experienced talent in big data, artificial intelligence and IT departments is making it difficult for companies to properly utilize these technologies. Businesses will be able to more effectively utilize analytics when they can train their employees on the skills required for their positions.

Vision & Alignment between all key stakeholders is key

In order to successfully adopt Big Data analytics technologies, companies must first establish a clear business case for their use. The business case should include information about the technology's capabilities, limitations, and benefits for users.

About the authors

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Ayoub MAMDOUH is Managing Director of OCP SOLUTIONS, a consulting firm that offers solutions around Analytics, Digital and Strategy. Prior to his current position, he was one of OCP Group's vice presidents, as head of Strategic & Quantitative Modeling division.
Ayoub graduated from the Ecole des Mines de Paris (P03) (current Mines ParisTech). He also holds an Executive Master in Business Administration from the Africa Business School in collaboration with Columbia Business School (2018).
He has worked in several areas including quantitative finance, human resources, marketing, and strategy consulting before joining OCP Group. He was selected among 2014's "Espoirs" Tizi award and was granted a training session in Harvard Kennedy School on Emerging Leaders. He is also an alumnus of the Atlantic Dialogues Emerging Leaders program (ADEL, 2015).
Ayoub is a past president of the Tariq Ibnou Ziyad Initiative, a Moroccan initiative that promotes both the participation of young people in politics and political leadership in Morocco. He is also a public speaker (TEDx and other events) and has lectured at several Moroccan schools

Adnane MOULIM

Adnane MOULIM is Partner in charge of Modeling and Advanced Analytics within OCP SOLUTIONS since 2016.
He has acquired during 19 years rich and varied experiences in the financial sector, particularly in quantitative modeling, advanced analytics, investment banking, commodities, supply chain and risk Management and financial markets. He was formerly head of Quantitative Team at Natixis for commodities and portfolio Management.
Adnane graduated from ENSIMAG (Grenoble, France) as an engineer majoring in Applied Mathematics and Finance. He also holds an Executive MBA from Africa Business School in collaboration with Columbia Business School.

Mohammed Mahdi AKKOUH

Mohammed Mahdi AKKOUH started working with OCP SOLUTIONS in 2019, and he is currently Principal in charge of Modeling and Advanced Analytics.
He has accumulated a diverse and rich experience in the course of 15 years in the financial and industry sectors, particularly in quantitative development, project management, advanced analytics, supply-chain and performance management.
Mahdi started his career at Natixis as a Quantitative Developer in interest rates derivatives. After a few years, he was appointed as Manager of the development and integration team of interest rates derivatives. He relocated to Singapore in 2015 to take a position as analytics manager at ANZ, where he managed numerous projects involving pricing, risk and commodities.
Mahdi is a computer science engineer graduate from ENSIAS (Rabat, Morocco) specialty software development and holds a Master in Financial Markets Innovation and Technology from SKEMA Business School (Sophia Antipolis, France).

About OCP SOLUTIONS

OCP SOLUTIONS is a consulting firm that offers solutions around Analytics, Digital and Strategy.
It was founded to serve OCP, Moroccan, African and international companies.
The firm offers solutions in Quantitative Modeling & Data Analytics whether through model implementation or advanced data-science and decision support tools for data enhancement and decision support. It delivers also solutions in Digital Transformation by using the digital to create/improve processes, business models and user experience. Finally, the firm delivers solutions in Strategy, Business Transformation & Innovation by defining and selecting value-creating strategic solutions that combine innovation and benchmark.
With a multidisciplinary team, OCP SOLUTIONS associates experienced consultants coming from several horizons to provide clients a whole satisfaction in the management of their projects.

The views expressed in this publication are those of the authors.

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