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MACQUARIE UNIVERSITY
GRADUATE SCHOOL OF MANAGEMENT

Supply Chain Big Data Series Part 2

**Key big data tools and platforms to
enable supply chain data management**

June 2018

www.kpmg.com/us/supplychain



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Foreword

More than ever before organisations are faced with streams of data flooding in from various channels at an accelerating rate. Data overwhelm can hamper an organisation's ability to keep up with data inflows and derive valuable insights.

The problem can be exacerbated by interactions between internal and external parties up and down the supply chain which, in turn affect business operations.

It is becoming increasingly apparent that supply chains that learn to harness the power of the data sources benefit significantly; leveraging the advantages of advanced analytics, supply chains can become more responsive, demand driven and customer centric.

Decision makers in supply chains are seeking ways to effectively manage big data sources. There are numerous examples of supply chain operations applying big data solutions which demonstrate the abundance of process improvement opportunities available through the effective use of data:

- Big data solutions that support integrated business planning are currently helping organisations orchestrate more responsive supply chains as they better understand market trends and customer preferences. The triangulation of a range of market, sales, social media, demographic and direct data inputs from multiple static and dynamic data points provides the capability to predict and proactively plan supply chain activities.
- The Internet of Things (IoT) and machine learning are currently being used in predictive asset maintenance to avoid unplanned downtimes. IoT can provide real-time telemetry data to reveal the details of production processes. Machine learning algorithms that are trained to analyse the data can accurately predict imminent machine fails¹.
- Big data solutions are helping avoid delivery delays by analysing GPS data in addition to traffic and weather data to dynamically plan and optimise delivery routes.
- Applications of big data at a global level are enabling supply chains to adopt a proactive rather than a reactive response to supply chain risks (e.g. supply failures due to man-made or natural hazards, and operational and contextual disruptions).

These examples provide just a glimpse into the numerous advantages derived from the analysis of big data sources to increase supply chain agility and cost optimisation. While it is a relatively new approach, it is being embraced by supply chains globally.

In this series we aim to present a more in-depth exploration of the world of big data and the significant opportunities it provides for supply chains to increase agility and efficiency. To this end, in Part 1 of the series we explore the concept of big data and how it is differentiated from small data. We then move on to identify big data sources and the applications of big data solutions in supply chain operations, and the skills required for supply chains to gain analytical competence and avoid paralysis by analysis.

Part 2 considers the main tools, platforms and methods currently used to analyse large portions of data depending on the type and form of data available and the problems to be solved.

In Part 3 we investigate supply chains of the future and how we believe they will utilise the power of data to become more agile, responsive, demand driven and customer centric. Furthermore, we discuss supply chain risk management and resilience enhancement practices and illustrate how these practices are being used to benefit from big data solutions to deliver more effective operational results.

Part 4 investigates the role of disruptive technologies such as IoT, machine learning and blockchains in transforming supply chains.

As a leading supply chain consultancy firm, we at KPMG share our experiences with some of our clients of successful applications of big data. Using KPMG tools and methods we reveal future insights into big data applications in supply chain operations.

We would like to thank all the dedicated people including our colleagues at Macquarie Graduate School of Management and our loyal clients that have helped us to compile this study. We would also like to invite the viewers of this paper to contact us with any questions of how we could help their supply chains thrive in the age of big data.

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¹ Jacob LaRiviere, Preston McAfee, Justin Rao, Vijay K. Narayanan and Walter Sun, Where Predictive Analytics is Having the Biggest Impact, Harvard Business Review 2016.

Big data enablement in your supply chain

Big data tools and techniques



Big data tools, platforms, and techniques

The nature of big data calls for a multi-disciplinary approach, spanning skills and expertise in computer science, applied mathematics, statistical analysis and economics to facilitate the analysis of large and various sets of data. Current tools and techniques developed for this practice are abundant and some even context-specific. Big data analytical tools originate from various sources including businesses and academics developing these tools for personal and internal use, or as a product or service to other businesses. Moreover, there are some tools originally designed for analysing smaller datasets that are adaptable to large volumes of data applications.

Big data techniques can be categorised in various forms. For instance, they can be discussed based on the discipline they belong to (statistics, mathematics, economics) or investigated according to the type of data they are designed to analyse. The latter is discussed in this paper.

In the following pages some of the most common big data tools and platforms are introduced with respect to serving the needs of supply chain data analysts and decision makers. The big data platforms are usually a coalition of several big D&A tools mainly provided by large software companies around the globe such as IBM, SAP and HP.

Horses for courses—what analytics techniques will best serve your data?

Most of the techniques used for analysing big data are rooted in statistics and computer science machine learning. Overall, big data analytics techniques are widespread and context-specific. However, these techniques can be categorised and discussed according to the type of data under interrogation.

Dependent on the type of data, five main big data analytics sections can be defined²:

- | | |
|---|--|
| 1 Text Analytics | Techniques used to extract information from textual data.
Text analytics includes statistical analysis, computational linguistics and machine learning. Some of the main techniques for text analytics are information extraction, text summarisation, question answering and sentiment analysis. |
| 2 Audio Analytics | Techniques used to extract information from unstructured audio data. Currently customer call centres and healthcare providers are the primary users of audio analytics. Some of the main techniques used for audio analytics include large vocabulary continuous speech recognition and phonetics-based systems. |
| 3 Video Analytics | Techniques used to monitor and analyse video streams. Video analytics has been primarily used as a replacement to labour-based surveillance. More applications of video analytics are being considered in retailing businesses to collect data on customer demographics and their preferences. Some of the main techniques used for video analytics are server-based architecture and edge-based architecture. |
| 4 Social Media Analytics | Techniques used to analyse structured and non-structured data from social media channels. Social media analytics spans several areas of research including psychology, sociology, computer science, economic, physics, and mathematics. Some of the main techniques used to analyse social media data are community detection, social influence analysis and link prediction. |
| 5 Predictive Analytics² | Techniques used to predict future outcomes based on anecdotal and current data. Historically, predictive analytics has been the domain of statistical analysis. However, conventional statistical analysis methods are based on sampling, significance and small sets of data. Thus, there have been calls for developing new techniques capable of big data statistical analysis, which will shape the future of predictive analytics using big data. |

² Amir Gandomi, Murtaza Haider, Beyond the hype: Big data concepts, methods, and analytics, International Journal of Information Management, Volume 35, Issue 2, April 2015, Pages 137-144

“As a supply chain and logistics professional, I am extremely excited about the additional optionality big data is able to provide. Although the fundamentals of supply chain management will always remain the same, trading off customer service, supply chain costs and working capital, big data allows enhanced customisation, better informed trade-off management and far more reliable demand predictions. Big data enables true supply chain optimisation.”

Henry Brunekreef, Director, Advisory, KPMG Australia

“Huge sets of unstructured and complex transactional data are driving a transformational change in supply chains. Companies have realised that competitive dynamics are quickly shifting towards having capability to mine and analyse real-time data to derive value-driven, predictive and prescriptive business insights to build intelligent supply chains.”

Yatish Desai, Managing Director, Advisory, KPMG US

Case. KPMG delivers: advanced analytics in retail forecasting³

KPMG recently helped a retail company better understand and predict demand for site selection and financial forecasting, and improve demand planning for store operations and replenishment.

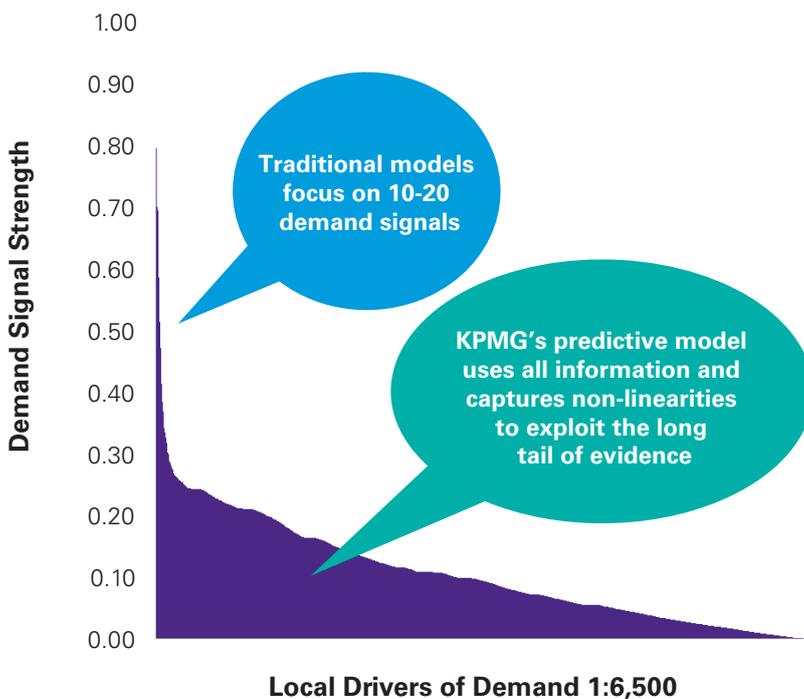
Initial investigations by KPMG showed that the company's revenue forecasting for new store locations had high historical error, with some errors exceeding 50 percent. Before contacting KPMG, the company had unsuccessfully attempted to address the issue internally or with consulting firms. Change management was a consideration. Additionally, revenue has a ramp-up period of roughly 24 months which added complications to revenue forecasting.

To tackle the issues, KPMG concluded that understanding and predicting demand using local and dynamic data was the key challenge. Thousands of demand signals were uncovered, correlated and linked to help accurately forecast the demand and optimise replenishment.

The project approach and main outcomes include:

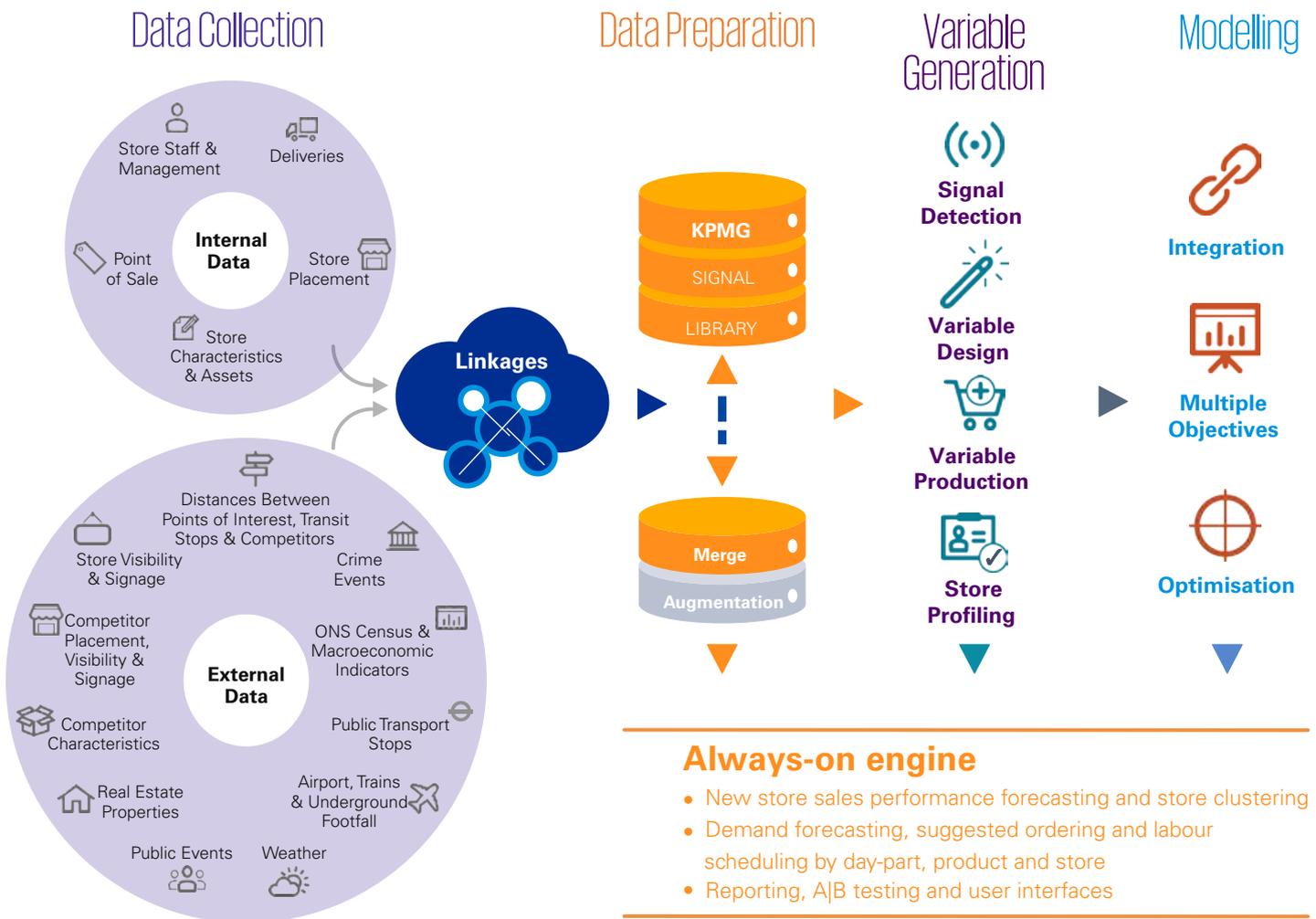
- 1 Average forecast error was reduced from 28 percent to 16 percent. Improvement for some stores was more than 3.1x.
- 2 The KPMG capability was based on 6,500 external and 5,250 internal demand signals.
- 3 Advanced analytics were used to assess the correlation of the demand signals, store signatures and store clusters.
- 4 In addition to the forecasting for new stores, an always-on store replenishment forecast was created in 2-hour buckets, by store and by item.
- 5 The model was hardened into an enterprise-grade solution and expanded to include forecasting for store operations and replenishment.

KPMG predictive models comprise and correlate all information to produce accurate forecasts



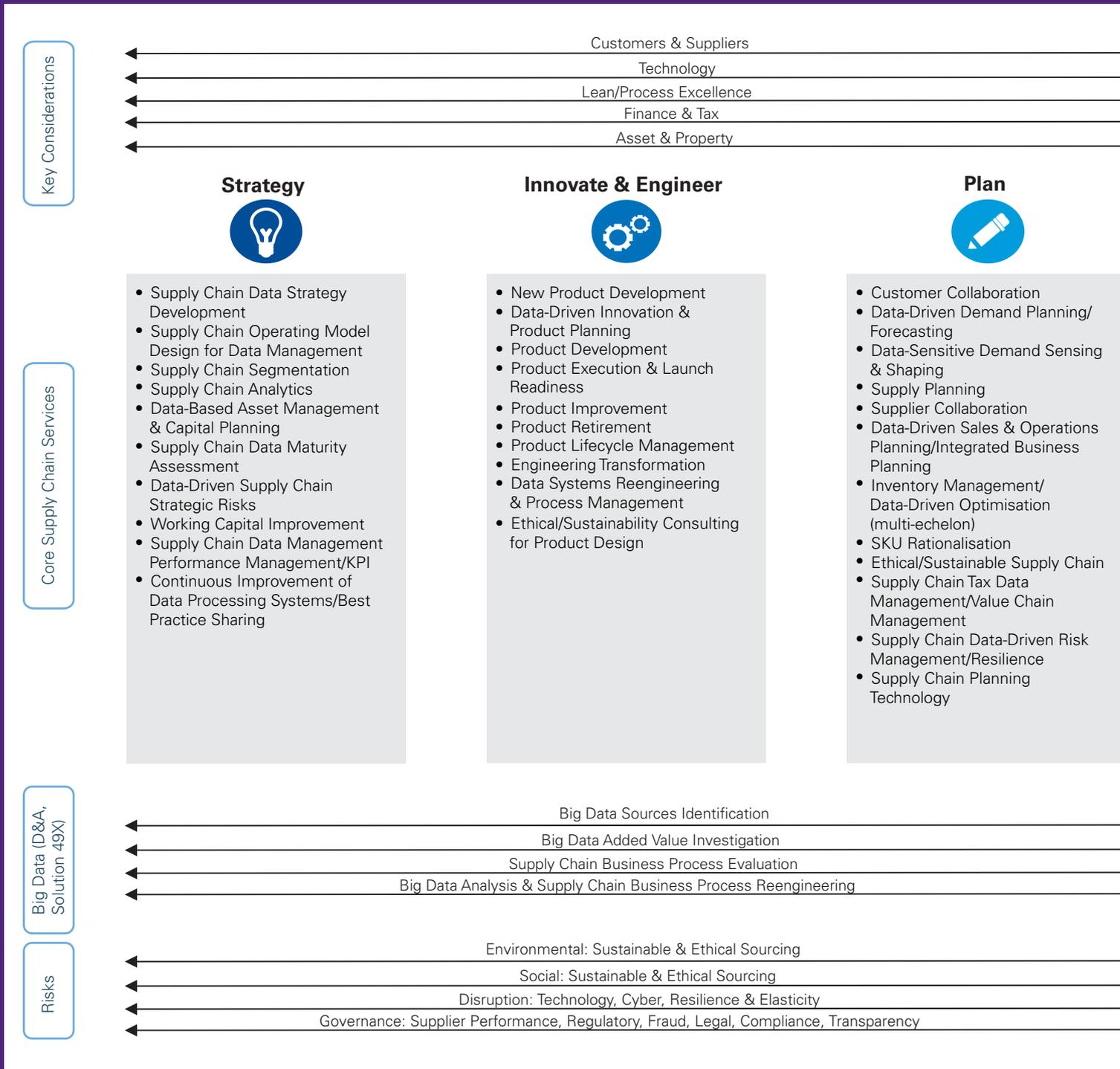
³ We Model behaviour and Change it, KPMG Case Study (2015).

Securing data sources and processing the data into meaningful demand signals, advanced data science and applied mathematics are used to analyse & process the data.



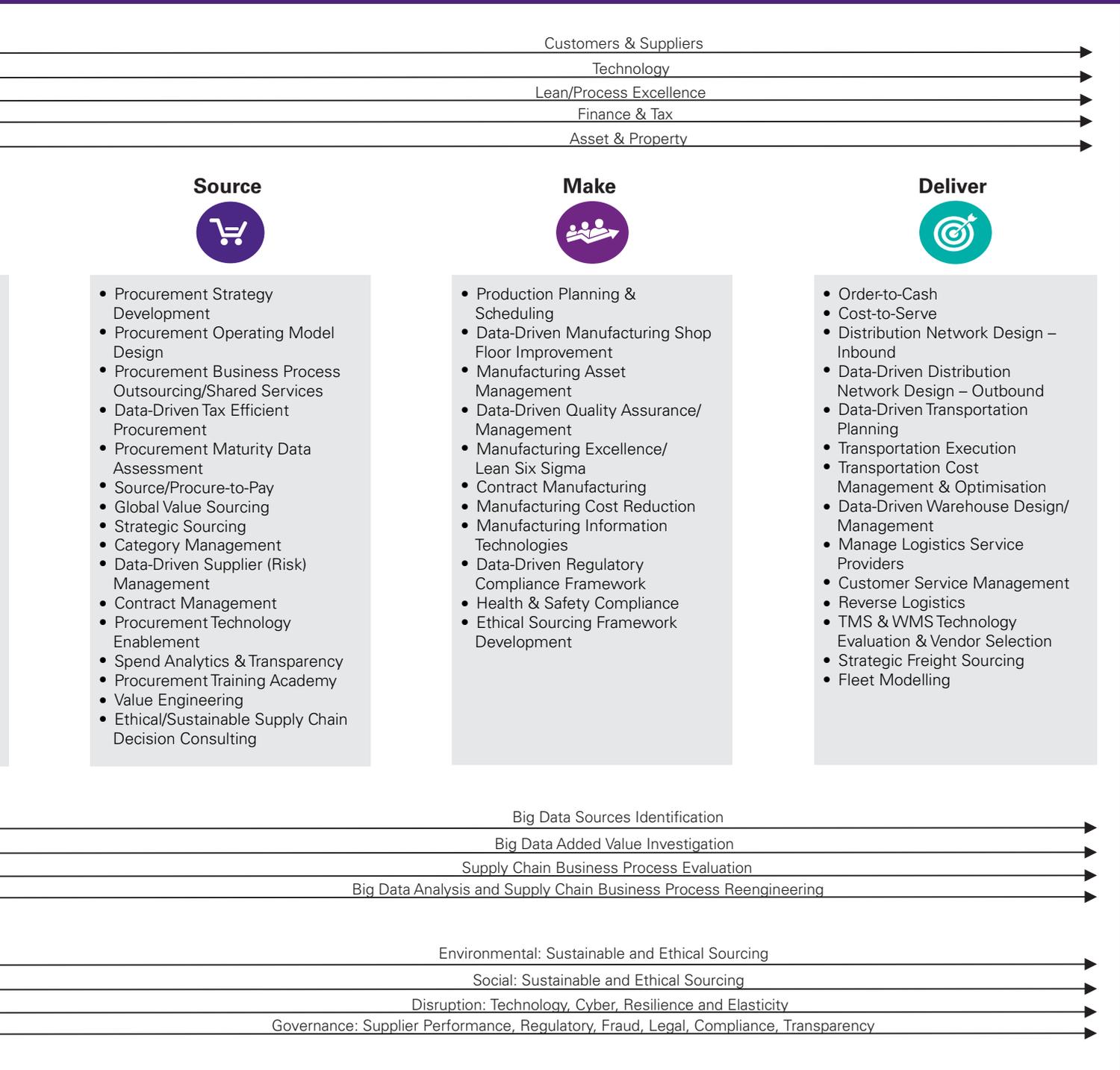
How KPMG can help your organization enabled in supply chain management

We offer a variety of big data and analytics services to our clients. By leveraging our global KPMG teams—supply chain, D&A advisory and Solution 49X—we can

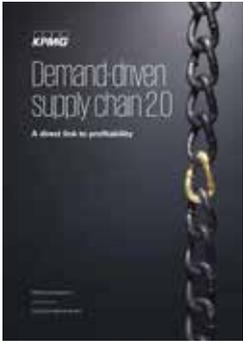


Organisation become big-data management

Using the latest advancements and technologies, and the skills and experience of our experts, we can assist your supply chain in becoming agile, efficient and forward thinking.



Related KPMG thought leadership publications



Demand-driven supply chain 2.0: A direct link to profitability, KPMG 2016
<https://home.kpmg.com/xx/en/home/insights/2016/04/demand-driven-supply-chain-2-0.html>



The future of retail supply chains, KPMG 2016
<https://home.kpmg.com/cn/en/home/insights/2016/05/the-future-of-retail-supply-chains.html>



Going beyond the data: Achieving actionable insights with data and analytics, KPMG 2014
<https://home.kpmg.com/us/en/home/insights/2015/05/achieving-actionable-insights-with-data-and-analysis.html>



The disruptors are the disrupted: Disruptive technologies barometer: Technology sector, KPMG 2016
<https://home.kpmg.com/sg/en/home/insights/2016/11/disruptive-technologies-barometer-technology-sector.html>



Going beyond the data: Turning data from insights into values, KPMG 2015
<https://home.kpmg.com/xx/en/home/insights/2015/06/going-beyond-the-data-turning.html>



Consensus: Immutable agreement for the Internet of value, KPMG 2016
<https://home.kpmg.com/us/en/home/insights/2016/06/consensus-opportunities-blockchain-and-beyond.html>

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May 2018. VIC N15266ADV