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Supply Chain Big Data Series Part 4

Disruptive technologies, analytics and the future of supply chains

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www.kpmg.com/us/supplychain

Contents

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 fails[1].
- 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.

Supply chains of the future: Disruptive technologies, analytics and the future of supply chains

Increasing operational efficiency and control through data

How the Internet of Things, telemetry, cognitive machine learning and big data are disrupting today's supply chains

Manufacturing industries and service sectors alike are increasingly investing in disruptive technologies to enhance their operational efficiencies and improve customer experiences. Some of the most disruptive and practical technologies invested include IoT and telemetry—enabled by intelligent big data and analytics—for remote monitoring and maintenance[2].

International Data Corporation (IDC) defines IoT as "networks of uniquely identifiable end points (or things) that communicate without human interaction using IP connectivity—be it locally or globally".[3] To make the concept of IoT more comprehensible, an example is provided below[4]:

"The day will come, not far from now when your alarm will be synced into your e-mail account and if an early meeting is cancelled your alarm will automatically reset to a later time, which will also postpone the coffee machine to the new wake-up time. Your fridge will know what is in it and place online orders to replenish stocks without you having to do anything. You'll put on your suit, with a payment chip in the sleeve so you can swipe payment for lunch without a credit card."

Such an example is only the beginning for the application of IoT for personal use (supported by other sources of data coming from wearables, sensors and micro-chips for health monitoring that are analysed using big data methods to serve the needs of individuals).

In the context of supply chains, the application of IoT is boundless. In manufacturing, sensors and micro-chips connected to machinery and facilities will provide real-time data of the machine's operational status, inventory in use, and the overall production conditions such as temperature, humidity, light and motion, to name a few. Such operational data, in the format of big data, can then be transmitted as a telemetry or state data. This data can be used by analysts to detect impending machine failures, optimise operational conditions and carry out production rescheduling.

At the customer level, IoT can be used to monitor customer purchasing behaviours and optimise inventory levels to avoid stock-outs and improve customer service.

The latest example is illustrated by Amazon Go which uses the sensors on the shelves of its stores to detect the products picked by the customers, add them to their virtual card and then charge the customers once they leave the store without waiting in lines to pay for the purchase. This IoT and deep learning solution is not only convenient for customers, but it is also cost effective for the store as it minimises human interference and provides customised datasets of customers and their shopping preferences for more accurate demand planning.

Inventory management and warehousing is another area that can be significantly improved using IoT—especially within the warehousing sector where there is a need to monitor the movement of stored components and products and track them constantly to make sure the right stock has been shipped to the right location. Using RFID tags and sensors, the precise location of an item, its movement through the warehouse and beyond, and other critical information (such as where the stock came from or when it is due to be expired and the physical condition and compliance) can be obtained and recorded. The same RFID tags and sensors in conveyor robots in the warehouse can synchronise robots' movements throughout the warehouse and optimise their utility and scheduling by monitoring their downtimes and working times and the amount of stock that they carry[5].

IoT can provide a connected transportation in supply chains, which links transportation vehicles via GPS, RFID, and other required sensors to increase transit visibility by identifying location, cargo, and other tracking information of vehicles. The data gathered from GPS and RFID will also help analysts determine the accurate time of cargo arrival, dynamically optimise routes and avoid potential delays as well as capture important cargo monitoring details such as temperature, humidity, and other changing parameters that can affect the quality of products during transportation.

2 The disruptors are the disrupted, Disruptive technologies barometer: Technology sector, KPMG 2016.

3 http://www.idc.com/promo/thirdplatform/innovationaccelerators/iot.

4 Bernard Marr, Big Data: Using SMART Big Data, Analytics and Metrics to Make Better Decisions and Improve Performance, Wiley 2015.

5 http://www.supplychain247.com/article/enter_the_smart_internet_of_things_warehouse/warehousing

"In an age of supply chain volatility and complexity, intelligence-enabled decisions are essential. The convergence of digital and physical infrastructures has changed the landscape of supply chain management through embedded intelligence creating a dialogue of actionable insights. Sensor-driven solutions will not only be used to instantaneously respond to fluctuations but also predict future conditions; transforming the supply chain process into a proactive, rather than a reactive function."

"IoT continues to enable the optimisation of supply chains to operate at vastly enhanced performance levels, however a greater opportunity lies in driving business-wide value creation. Using the unprecedented level of insights derived from legions of supply chain sensors, business leaders should sculpt an organisation-wide strategy to unlock holistic operational optimisation and competitive advantages."

"Shifting the lens from an efficiency and cost-centric focus to that of value creation, the supply chain function could transform the role it plays within an organisation. Moving to a knowledge-as-a-service model for both internal and external stakeholders facilitates the evolution of the supply chain as a source of value creation that could provide significant business impact, differentiation and return."

Tristan Masters, Director,
Solution 49x, KPMG

This data can also be analysed simultaneously with environmental data (e.g. weather or traffic data) to optimise routing and preserve the conditions of products subject to environmental changes.

Machine learning is another emerging area of focus in supply chains that goes hand-in-hand with IoT and big data analytics. It is a type of learning that enables machine reprogramming based on empirical and iterative data received by the machine. Some famous examples of machine learning are Google car, the product recommendations by Amazon or Netflix and Facebook's personalised News Feed.

All the applications of IoT and telemetry mentioned so far can be used in machine learning algorithms so that the algorithms will reveal hidden patterns in optimising upstream and downstream supply chain operations. For instance, in a warehouse, camera data for monitoring stock levels can be used in machine learning algorithms to predict when restocking will be required. Or in transport, the temperature of containers can automatically be adjusted to the external environment to preserve the quality of products.

This provides only a glimpse into the various applications of disruptive technologies in supply chains through the application of big data analytics and the endless opportunities they provide to optimise processes and further increase the agility in supply chains.

A new link in the chain: blockchains and their emerging role in supply chain management

Blockchains are a specific type of a distributed ledger and a way of ordering and verifying transactions into blocks with various protections against tampering and revision. A network of computers maintains and validates a record of consensus of the transactions via a cryptographic audit trail. A distributed ledger means that no single centralised authority, like a clearinghouse, verifies and executes transactions. Instead participants have computers that serve as nodes within the network.

Some or all of the nodes verify and, if appropriate, execute proposed transactions to an agreed-upon algorithm called the consensus mechanism. The transactions are then encrypted and stored in linked blocks on the nodes, creating an audit trail[6].

Blockchains will eliminate the need for intermediary organisations that handle financial and non-financial transactions in supply chains, which will in turn culminate in reduced overall supply chain costs and increased visibility and reliability among supply chain members.

One of the most famous applications of blockchains is the Bitcoin, a crypto-currency that could be used as a game changer in supply chain financing[7]. However, in the context of the applications of big data analytics in supply chains, the main role that blockchains play is to increase data security and create data transparency for supply chain members and customers—along with increasing trust on the flow of material from raw initial components provided by suppliers to the end customers.

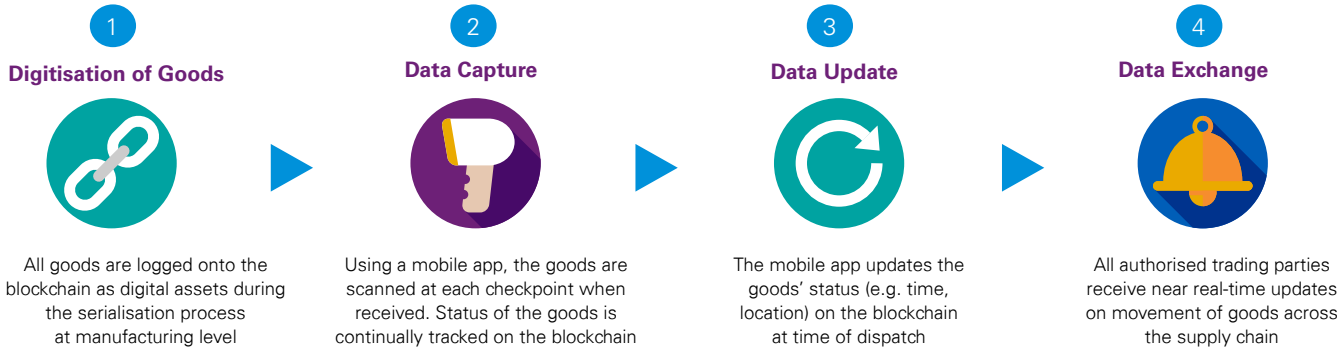
In other words, blockchains increase the reliability and security of the large volumes of data generated in supply chains for the subsequent applications of big data solutions to this data for information creation.

At the heart of blockchains relies the consensus of all agents when a change in the data is about to happen. This decentralised system in supply chains means that once the record of products and processes is included in the blocks, any sort of data infringement is almost impossible since the block is shared with multiple supply chain members and the consensus of the members is required for making any possible change on the data. Therefore, there will be a formal registry that records data on all products and services available in supply chains with high accuracy, which can then be analysed with big data analytics tools and methods to understand product origin, integrity and components etc.

Recent applications of blockchains in supply chains include IBM's Blockchain helping supply chains of luxury products, such as diamonds (Everledger), so buyers are informed about the origins of the product[8] or Walmart's Blockchain designed to track the movement of pork in its Chinese supply chains[9].

Blockchains consist of various consensus mechanisms, sometimes even in the format of bilateral agreements, which should be taken into account for reliability, consistency, governance, security and failure redundancy[10].

How blockchains work[11]



6 Consensus opportunities: blockchain and beyond, KPMG 2016.

7 Erik Hofmann , Mark Johnson , (2016) "Guest editorial", International Journal of Physical Distribution & Logistics Management, Vol. 46 Iss: 4.

8 http://www.wsj.com/articles/ibm-pushes-blockchain-into-the-supply-chain-1468528824.

9 http://blogs.wsj.com/cio/2016/10/19/wal-mart-turns-to-blockchain-for-tracking-pork-in-china/.

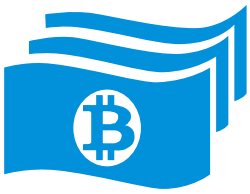
10 For more information on blockchains and consensus mechanisms, please see the KPMG 2016 report: Consensus opportunities: blockchain and beyond.

11 Driving Supply Chain Visibility through Blockchain, KPMG Report 2016

Some of the impacts of the applications of blockchains to supply chains can affect[12]:

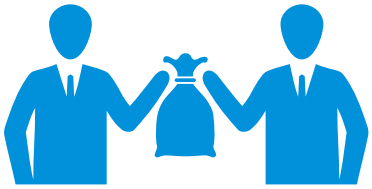
- Trade finance settlements
- Smart contracts—e.g. upon receipt of goods
- Human rights—e.g. slavery and forced workers, human trafficking, fair wages and child labour
- Animal liberation—e.g. animal testing, exploitation and experimentation
- Product labelling claims—e.g. organic, vegetarian, nut-free, protein or sugar content, calories, gluten content, GMO, fat content and other product labelling
- Criminal activity—e.g. counterfeiting and forgery, re-packaging, interference and tampering
- Product origins—e.g. blood diamonds (Everledger), conflict minerals
- Environmental sustainability—e.g. palm oil from owners that burn crops.

Cost advantages



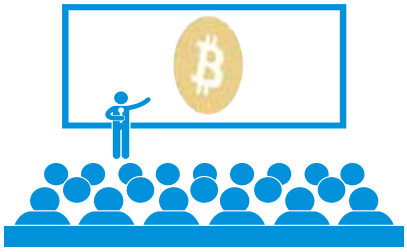
- **Very low transaction and user fees** (about 0,03 € vs. 2-5 percent debit/credit card)
- **No chargebacks** and related charges/administrative efforts
- **High potential for automation** of payment transactions
- **No monthly fees**
- Instantaneous capital effects through **direct transactions without delay**

Functional advantages



- **International payments (24 x 7) in real-time**
- **Micropayments possible** (1 Bitcoin can be divided into 100m pieces)
- **Public ledger** (wallet sharing, tracking of spending habits, marketing purposes)
- **Easy integration** in existing business models
- **Existing software and solution provider** infrastructure (e.g. wallets, payment, exchanges, etc.)

Potentials for growth



- **Access to new customers and markets** (international payments, technological affine segments)
- **Access to customers** with not sufficient credit ratings/ no access to int. payment system (Africa, India)
- Creation of **new business models**/products using electronic payments/micropayment/ smart contracts

"Recently emerging blockchain-based distributed ledger technologies herald a new era of transparency and trust across supply chains. The impact of blockchains on supply chains is magnified when combined with analytics to ensure integrity, value and predictive insights."

Bob Hayward,
KPMG Singapore

12 Digital Ledger in Supply Chain: Blockchain Solution for Supply Chain, KPMG Report 2016.

Case. JDA's success story in harnessing the power of data in supply chain management[13]

KPMG was hosted by JDA Vice President, Mr. Bruce How, to discuss the role of big data and analytics in supply chain process improvement and performance enhancement. JDA is the world-leading provider of end-to-end, integrated retail and supply chain planning and execution solutions.

As one of the best-known experts in this field in Australia, Bruce is very passionate about the applications of big data in supply chain analysis. He shared with us his vision of supply chains of the future and the steps to be taken to actively use the power of big data for the benefits of supply chains. Here is the summary of KPMG's interview with Bruce.

13 Interview with Bruce How, Vice President, JDA Software Australia (Dec 2016).

Please tell us about your professional background and your field of activity within JDA.

I worked in enterprise software for approximately 20 years and have been fortunate enough to work in a number of different locations and companies including the UK and Europe, North America, APAC and ANZ. So I have a pretty broad range of experience mainly in the enterprise software platforms but specifically in supply chains for a bulk of that period. I also have a very keen interest in economics and write regular blog articles about different experiences and observations that I have.

How important do you think data and big data are for process improvement in supply chains, and why?

If you go back to the really basic economic principles of supply chains that we are going to start taking ourselves towards, we have a concept of 'perfect market' where the buyer and the seller have complete information and make rational decisions. We are now in the world where the buyers have almost the perfect information—they can easily access product specifications, price, competitors' prices, and they have the ability to almost make the perfect decision. However, for a seller to do the same this becomes a massive challenge. The seller deals with an incredible amount of data. It has to make much more complex decisions. So whether you are a manufacturer or a retailer, the decisions you have to make are much more difficult than a buyer's. Thus, big data and the quality of data that we now have access to allow manufacturers, retailers, and distributors to start thinking about making more perfect economic decisions. Most decisions are typically: What do I make? What assortments do I put in which stores? Where and when do I promote? How much do I actually sell something for? What are my competitors doing in terms of product, assortment, pricing etc.?

So big data is actually going to be one of those game changers for organisations that are understanding the full potential of it. Because big data is going to make these organisations, economically, perfect suppliers.

What are the main sources of big data in supply chains?

There has always been traditional data, which was used in enterprise decision making. If we look at the consumer's point of sales (POS) data, for a long time that has been actually a source of big data. POS has always challenged most organisations, since it was hard to digest in terms of the items sold, the time of day the item was sold and the promotional activities that were associated with them. So traditional data has always had the volume side to it. Retailers have typically owned that information and some of it has passed back down to manufacturers. So there was this understanding of the existence of transactional data that filters itself through various different layers and eventually results into the supply chain getting orders from the investigation of what is going on from the consumers' point of view. So we had large volumes of data that were aggregated back in forms of orders to the supply chain. In addition to POS data, the organisational data could be another source of big data in supply chains.

What does your organisation look like? How is it distributed? How are the products structured and manufactured? What is the lead time between the warehouse and the distribution centre so that there will an understanding of the supply chain network data? And lastly there is the performance data of the organisation in terms of the number of fulfilled orders, fill rates, costs and revenues to name a few. All these types of data can be considered traditional data that supply chains have always wrestled with and could form a repository of the big data in supply chains.

In addition to traditional sources of data, there are new data sources that have come into play which include the social data (what consumers are talking about in terms of supply chain products) and macro segments of demand (highly publicised bloggers who associate themselves with fashion supply chains). Moreover, many manufacturers are now understanding the value of their own brand and strategies that address their consumers directly and not always through intermediaries. Using social media apparatus, manufacturers can have the ability to increase loyalty of their consumers to their brand. The latter precludes the interference of retailers that have been top performers in creating and promoting brand loyalty among customers.

Within supply chains, we are witnessing the dawn of the new data sources including telemetrics, which is becoming increasingly important in supply chains. Through telemetrics the actual execution of the operations within supply chains can be monitored very accurately. Whether telemetric tools are attached to mobile devices or being physically attached to employees, warehouses or transport vehicles in supply chains, they provide detailed transactional data that could be used to monitor supply chain performance more closely.

Of course we should also be expecting machine data and IoT in the near future as another new source of data in supply chains. So, overall we can say there are enormous amounts of traditional and new sources of data that exist, and pulling them all together without the tools and methods of big data can become a very difficult puzzle.

How do you think the power of this amount of data can be effectively harnessed in supply chains?

In terms of the advantages of harnessing the power of big data, I go back to my answer earlier about the perfect supply chain model. Big data can help supply chains get very close to the perfect operational model, being agile and flexible enough to satisfy any amount and combination of orders by the consumers.

Harnessing the power of big data itself is not a new concept if you look at it for example from the POS perspective. A large amount of POS data is generated in grocery supply chains. And grocery supply chains have actually been quite successful in interpreting the POS data and benefiting from it.

The more a supply chain has the visibility of the demand signals, the better it can perform to satisfy customer demands, which has been the case for most grocery supply chains so far. Using POS data to gain transactional signals and interpret that in terms of orders through various layers of supply chains is construed as a traditional approach of harnessing the power data in supply chains. I think what is important nowadays in supply chains is how to harness the new sources of data and use them in the decision-making process. A good example to make this clear is the introduction of sports wearables for tracking steps and physical activity. The velocity of these wearables taking over the market was so overwhelming that sports and electronics retailers alike were competing to have these products on shelves first. The early adopters in terms of the retailers offering these products had to go through significant inventory and replenishment changes and adaptations to make these products available on their shelves and benefit from the sales and marketing advantages. Thus, in addition to traditional replenishment, big data can be leveraged through its predictive analytics capabilities to help with ahead-of-time replenishment even before the actual demand reaches the retailers.

Within JDA, what are the main tools and techniques for creating insights for your customers?

The key to many big data challenges in supply chains is to have smart people capable of tackling those problems. These people should have the ability to understand complicated problems, because these problems are effectively solved by mathematical tools. Since we have not got to the stage that machine learning alone could help us tackle big data problems, we need people who understand complicated problems and who can apply appropriate algorithms to solve these problems in a relatively short period of time. Specifically, unlike common understanding of big data being fast data, most of the time big data is rather clumsy and very difficult to manage. Therefore, we need to have people who could apply agile approaches to this type of data. In addition to this, having the operations research or statistics skills are critical for supply chain big data analysts.

What are some of the key big data projects that you have conducted in JDA?

Big data for us has always been about transactional data and there is a substantial amount of transactional data out there. However, JDA sits on a layer above transactional data. And it gives supply chains the tools to optimise specific parts of the transactional data required by our clients.

It all depends on which part of the supply chain the operations are not performing optimistically from supply chain members' perspectives. However, the optimisation practices using the transactional data are usually operations-specific. Very few organisations indeed try to optimise every part of their supply chain.

In general, it is important to prioritise and solve the most important problems in supply chains using the right set of data instead of focusing on solving problems that would not have much added value in the end.

Where do you think we go from here with the application of big data in supply chains?

I think the future is very exciting for the professionals in this space. For a long time supply chains and what has been happening at the consumer part of them were pretty static—not much has changed in retail management for many years now. But we are now in a world where everything is changing at a pretty fast pace. Considering these rapid ongoing changes, there are a number of interesting areas that supply chain analysts could be engaged in more in the future.

There is going to be the consumer-led supply chain which is almost a new concept and will result in a pure demand-driven supply chain rather than the traditional way of manufacturers producing what they would prefer and subsequently try to sell it to the customers. This creates a whole set of micro models for all members of the supply chain to manage. So the profitable supply chains of the future are the ones that adapt early and identify these new micros and sell to their customers accordingly. And this actually is not about price anymore but it is more about innovation and service. These consumer-led plans and data signals in turn will result in more dynamic planning at the supply chain side to make it more responsive and aligned with consumer preferences. All this relies enormously on getting and using the right set of information at the right time in supply chain processes.

I think it is a really exciting time for the supply chains. Organisations that move the fastest in the big data space will constitute the fittest supply chains of the future. But one of the topics I am most passionate about is investment in thinkers, smart people who can think outside the box and are encouraged to ask difficult questions and challenge the status quo. Supply chains of the future will need more disruptive non-linear thinkers.

Case. KPMG reports: How the world's leading supply chain is applying big data analytics across clients' global supply chains[14]

DHL provides some of the most innovative supply chain solutions using big data and analytics, which have saved supply chains across various sectors of industry and services millions of dollars and have brought with them considerable amount of financial and reputational advantages for the company.

Below contains examples of some of their most successful projects using big data and analytics:

DHL's supply chain unit has implemented big data analytics projects to address food management and waste in airports. In addition to recycling wasted food into fuel for planes, DHL has harnessed the power of big data to design the menus and procure food to minimise the costs of excess food transport on planes.

Using big data analytics and through an automated stock consumption platform, DHL has made it possible to predict what types of food passengers were most likely to consume on a particular flight, enabling food serving and storage on flights to be cost efficient and optimised.

Using big data analytics and their national uniform managed service (NUMS) platform, DHL developed an online platform that allowed the officers at MPS to order the most cost effective uniform based on their entitlements and allowances. From selecting the raw material to production and assignment of uniforms to individual officers, what had previously been a manual process became an automated and fully digitalised operation using NUMS as a fully digitalised commercial platform.

NUMS also enables advanced configuration flexibility that users can employ to quickly and easily complete complex system customisation.

Using wearables and automated response strategies, DHL will conduct bio monitoring of police officers to assure their health and safety. Wearable sensors usually generate large sets of data that require big data analytical tools to extract insights from them in order to monitor and control health conditions.

Common wearable sensors include gyroscopes, accelerometers, magnetometers, barometric pressure sensors, GPS, or sensors for gauging physiological, electrophysiological or chemophysiological properties of the human body for various applications and monitoring purposes.

14 Fujitsu Forum: Digital Disruption - How Can Companies Like DHL Keep Up With Digitisation? , Paul Richardson, Supply Chain Logistics Innovator & Problem Solver, DHL 2016.

"As the leading supply chain company in the world, DHL is helping shape the future of logistics. The transformation of data use and big data analytics is obviously an integral part of that. However, we are not working on big data projects in isolation—we are doing so in collaboration with our customers. We believe the value of advances in data analytics comes from harnessing new insights in collaboration with those customers. Our focus is on sharing knowledge with our customers in ways that will empower them to achieve new levels of competitive advantage."

Saul Resnick, CEO Australia, New Zealand, and Life Science Healthcare APAC

"Return on investment for analytics projects is a hot topic, and many are struggling to deal with this concept. There is a temptation to measure ROI based purely on individual use cases, but this understates both the investment in time and technology. It also completely misses the upside that businesses get when use-cases really start to break down the silos within an organisation that make it so much easier for the subsequent use-cases—an example being an unsuccessful use-case in delivery informing follow up use-cases with the same data and third parties in really successful warehousing and scheduling, due to there being so much more trust in the data, systems and importantly, people."

Anthony Coops, Asia Pacific Data & Analytics Leader, KPMG Australia

Roadblocks to big data solutions in your supply chain

The application of big data solutions to supply chain operations has its own share of caveats.

Some of the main hurdles that preclude supply chains from effectively applying big data solutions to their operations include[15]:

Needle in a haystack

As big data is becoming the new 'hype', the rush to apply big data analytics solutions can cause some issues in supply chains. Supply chains might use analytics randomly to spot causations and relations for their operational issues hoping they will come up with a solution. This approach can in turn lead to analysts being engaged in only number crunching and finding causations and correlations that are often false. Lack of a systematic approach in choosing the data sources to use and in targeting operational improvements in supply chains can not only waste resources (time, human capital, and financial capital) but it can also suggest incorrect remedies that can further harm supply chains rather than solving their problems.

Islands of excellence

Sometimes focusing on making improvements on a specific operation in a supply chain will only benefit that operation and have little bearing on optimising the whole supply chain. For instance, various D&A solutions for inventory management on manufacturers' and suppliers' sides can benefit manufacturers or suppliers in minimising their inventory holding and backorder costs. However, if not synchronised throughout the supply chain, the lack of inventory and ordering information visibility can intensify the bullwhip effect throughout the supply chain.

Measurement minutiae

Supply chains can have too many metrics for their performance evaluation practices. This means that either the quantity of the metrics is too much to handle and manage at the same time or that the metrics are not prioritised and can in some cases yield contradictory results that can make the problem at hand more overwhelming. This phenomenon is called measurement minutiae and can be addressed by refining the metrics and developing a list of KPIs for supply chain performance assessment which can have the most contribution to supply chain process improvement.

Paralysis by analysis

We have mentioned how big data analytics can help supply chains overcome paralysis by analysis. However, big data itself can sometimes cause paralysis by analysis. Many companies are overwhelmed by rapidly changing large volumes of data and the various platforms, methods and techniques available for obtaining data-derived value. Many have expressed their confusion in adopting big data technologies and thus find themselves in a state of paralysis. It is therefore crucial for supply chains to know where to begin, which data to use and which analytical approach and technology to choose.

15 Nada R. Sanders, How to Use Big Data to Drive Your Supply Chain, California Management Review, Vol. 58, Issue 4 (2016).

Summary

What we looked for

This series of papers delves deep into the less explored and rapidly growing field of big data solutions and their application to supply chain operations. The main purpose behind this series is to increase awareness of how supply chains can improve data integrity and visibility and gain significant insights from available structured and unstructured data.

What we delivered

We explored the concept of big data and what differentiates it from small data. We then discussed paralysis by analysis and examined how supply chains can adopt the right approach to big data problems.

We investigated the applications of big data solutions in various supply chain operations and how big data can be useful for supply chain enablers in achieving superior financial performance and positive tax impacts.

After identifying the main sources of big data and their applications in supply chain operations we moved towards recognising the main tools, techniques and platforms used worldwide and by KPMG.

In addition, we introduced sources of big data in supply chains, their applications and their qualities according to volume, variety and velocity.

Supply chain risk management through big data analytics has been another area of focus. We discussed how the power of big data can be harnessed to identify and prioritise risks, and enhance supply chain resilience.

We also examined the roles of disruptive technologies such as IoT, machine learning and blockchains in transforming supply chains through big data analytics.

In our efforts to unravel the hidden powers of big data and recent advancements, we spoke with industry experts and shared their insights into big data solutions in supply chains, and their vision of the future. We also reported on some of the relevant projects that KPMG has successfully delivered for clients along with sharing DHL's progressive role in providing big data solutions to businesses and supply chains.

What we are looking for in the future

The provision of this series could not be possible without the contributions of our people and our clients across various disciplines including Supply Chain/Operations and Data & Analytics.

Our vision of the future includes close collaborations across these areas to provide the most effective solutions for our clients around the globe.

We believe that supply chains of the future will find the role of data and analytics increasingly crucial in achieving agility, data integrity, high levels of responsiveness and resilience.

We also believe that our team of experts and the many years of experience we have had in successfully conducting similar projects for our clients equip us with the best tools and skillsets required for undertaking complex big data projects across supply chains in various industries.

For the progressive supply chains already investing in advancing their data and analytics capabilities, we see a bright future. For the supply chains yet to embrace the power of big data, we encourage them to consider the significant contributions it can make in achieving excellence in supply chain management.

How KPMG can help your orga enabled in supply chain mana

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

Key Considerations

- Customers & Suppliers
- Technology
- Lean/Process Excellence
- Finance & Tax
- Asset & Property

Core Supply Chain Services

Strategy

- Supply Chain Data Strategy Development
- Supply Chain Operating Model Design for Data Management
- Supply Chain Segmentation
- Supply Chain Analytics
- Data-Based Asset Management & Capital Planning
- Supply Chain Data Maturity Assessment
- Data-Driven Supply Chain Strategic Risks
- Working Capital Improvement
- Supply Chain Data Management Performance Management/KPI
- Continuous Improvement of Data Processing Systems/Best Practice Sharing

Innovate & Engineer

- New Product Development
- Data-Driven Innovation & Product Planning
- Product Development
- Product Execution & Launch Readiness
- Product Improvement
- Product Retirement
- Product Lifecycle Management
- Engineering Transformation
- Data Systems Reengineering & Process Management
- Ethical/Sustainability Consulting for Product Design

Plan

- Customer Collaboration
- Data-Driven Demand Planning/ Forecasting
- Data-Sensitive Demand Sensing & Shaping
- Supply Planning
- Supplier Collaboration
- Data-Driven Sales & Operations Planning/Integrated Business Planning
- Inventory Management/ Data-Driven Optimisation (multi-echelon)
- SKU Rationalisation
- Ethical/Sustainable Supply Chain
- Supply Chain Tax Data Management/Value Chain Management
- Supply Chain Data-Driven Risk Management/Resilience
- Supply Chain Planning Technology

Big Data (D&A, Solution 49X)

- Big Data Sources Identification
- Big Data Added Value Investigation
- Supply Chain Business Process Evaluation
- Big Data Analysis & Supply Chain Business Process Reengineering

Risks

- Environmental: Sustainable & Ethical Sourcing
- Social: Sustainable & Ethical Sourcing
- Disruption: Technology, Cyber, Resilience & Elasticity
- Governance: Supplier Performance, Regulatory, Fraud, Legal, Compliance, Transparency

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g the latest advancements and technologies, and the skills and experience of n assist your supply chain in becoming agile, efficient and forward thinking.

Customers & Suppliers

Technology

Lean/Process Excellence

Finance & Tax

Asset & Property

Source

- Procurement Strategy Development
- Procurement Operating Model Design
- Procurement Business Process Outsourcing/Shared Services
- Data-Driven Tax Efficient Procurement
- Procurement Maturity Data Assessment
- Source/Procure-to-Pay
- Global Value Sourcing
- Strategic Sourcing
- Category Management
- Data-Driven Supplier (Risk) Management
- Contract Management
- Procurement Technology Enablement
- Spend Analytics & Transparency
- Procurement Training Academy
- Value Engineering
- Ethical/Sustainable Supply Chain Decision Consulting

Make

- Production Planning & Scheduling
- Data-Driven Manufacturing Shop Floor Improvement
- Manufacturing Asset Management
- Data-Driven Quality Assurance/ Management
- Manufacturing Excellence/ Lean Six Sigma
- Contract Manufacturing
- Manufacturing Cost Reduction
- Manufacturing Information Technologies
- Data-Driven Regulatory Compliance Framework
- Health & Safety Compliance
- Ethical Sourcing Framework Development

Deliver

- Order-to-Cash
- Cost-to-Serve
- Distribution Network Design – Inbound
- Data-Driven Distribution Network Design – Outbound
- Data-Driven Transportation Planning
- Transportation Execution
- Transportation Cost Management & Optimisation
- Data-Driven Warehouse Design/ Management
- Manage Logistics Service Providers
- Customer Service Management
- Reverse Logistics
- TMS & WMS Technology Evaluation & Vendor Selection
- Strategic Freight Sourcing
- Fleet Modelling

Big Data Sources Identification

Big Data Added Value Investigation

Supply Chain Business Process Evaluation

Big Data Analysis and Supply Chain Business Process Reengineering

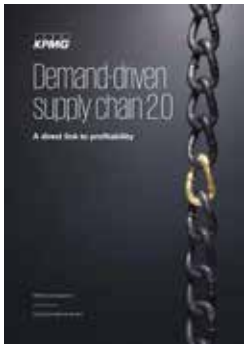
Environmental: Sustainable and Ethical Sourcing

Social: Sustainable and Ethical Sourcing

Disruption: Technology, Cyber, Resilience and Elasticity

Governance: Supplier Performance, Regulatory, Fraud, Legal, Compliance, Transparency

Related KPMG thought leadership publications



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