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**BIG
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Data is the Next Frontier, Analytics the New Tool

Five trends in big data and analytics, and their implications for innovation and organisations

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The Big Innovation Centre is an initiative of The Work Foundation and Lancaster University. Launched in September 2011, it brings together a range of companies, trusts, universities and public bodies to research and propose practical reforms with the ambition of making the UK a global open innovation hub as part of the urgent task of rebalancing and growing the UK economy, and with the vision of building a world-class innovation and investment ecosystem by 2025. For further details, please visit www.biginnovationcentre.com.

Executive summary

Big data might be increasingly fashionable in recent parlance, but many people still don't have a clue what it is about, much less what it implies. Data used to be the boring stuff, and analysing them a specialism of technically-trained statisticians. Increasingly, though, big data is becoming the next frontier of competitive advantage. Forward-thinking organisations are already proactively deploying advanced analytics on data to generate useful insights that can help leaders make better fact-based decisions with the ultimate aim of driving strategy and improving performance. On top of that, organisations are also beginning to spot innovation opportunities and niches by unleashing not just the diagnostic and predictive, but also the creative power of advanced analytics on big data to meet latent market needs with new, or improved, products and services.

This article identifies five trends in big data and advanced analytics, and suggests what they might hold for innovation and competitive advantage. It should not surprise many that in the near future there will be an avalanche of applications and services derived from open data, driven in large part by the government's initiative to open up a wider range of public data. This is likely to be followed by the private sector, where there will be a gradual opening up of data, albeit at a slower pace. Organisations will also increasingly find open source techniques and open platforms to be the way forward in amassing relevant data, generating useful insights and spawning innovations. Although numerical data have long been the staple feed of analytics and the basis on which business leaders make informed decisions, we will see the increasing prominence and proliferation of unconventional, or unstructured, data. The interconnectedness of organisational functions and the complexity of the ecosystem will lead to a convergence of information architecture that calls for the adoption of real analytics to holistically analyse fragmented and disparate information.

However, organisations that have historically invested heavily in technology and technological solutions for the purpose of managing and analysing data must not lose sight of six other key imperatives: data and analytics must take on a strategy-level orientation; analytics capabilities must be pushed deeper into all areas of the organisation; the CEO must drive the adoption of analytics across the organisation; the organisation's structure, processes and culture must be properly aligned to a data-driven strategy; investment in analytics capabilities must also involve acquiring and developing the right talent and institutional skills to harness the potential of data; and organisations must shift their paradigm to a more open, collaborative way of working, particularly with external stakeholders.

Data, data... and more data

It is a capital mistake to theorise before one has data. Insensibly, one begins to twist facts to suit theories, instead of theories to suit facts.

— Sir Arthur Conan Doyle, British mystery author & physician (1859–1930)

In the coming months and years we will increasingly hear the jargon “big data”¹ being brandished about primarily in both management and policy circles, but also increasingly in the academic fraternity. While as recently as a decade ago organisations paid handsome sums of money to acquire data, usually in the form of consumer demographics and market trends, today data are so readily available and come in various types, forms and formats that organisations are simply struggling to keep up.

Although some organisations can barely countenance the possibility of having to one day deal with, let alone allocate extra resources to manage, a potentially enormous amount of data, there is no escaping the fact that the amount of data in our world will continue to soar. Two years ago Google’s Eric Schmidt claimed we created as much information every two days as we did from the dawn of civilisation until 2003.² Two years on one wonders what multiples can be applied to Schmidt’s estimate. One estimate suggests enterprises globally stored more than 7 exabytes of new data on disk drives in 2010,³ while another expects the world’s storage capacity to grow by a compound rate of 50%, reaching 100 zettabytes by 2020.⁴ Annual consumer and business internet traffic flows will reach 1.16 zettabytes and 157 exabytes respectively by 2016.⁵

Yet for many organisations neither the volume of data nor where to store them is a problem. These issues are unlikely to make or break businesses. Instead, a key factor that determines whether organisations sink or swim in today’s rapidly evolving business environment is their ability to harness the potential and power of data by gleaning useful insights for decision-making and innovation.

Data are an organisational property created, whether deliberately or otherwise, in digital truckloads through an organisation’s operations. Given that the existence, and in many

¹ Big data can be defined in several ways, but the general consensus invariably emphasises size, storage, usage and analytical capabilities. McKinsey Global Institute’s definition of big data is perhaps one of the most precise and concise for the purpose of this article: “Datasets whose size is beyond the ability of typical database software tools to capture, store, manage and analyse”. See Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C. and Hung Byers, A. (2011), *Big Data: The Next Frontier for Innovation, Competition, and Productivity*, McKinsey Global Institute.

² “Google’s Eric Schmidt kicks off Techonomy Conference”, *CNBC Online*, 4 Aug, available at http://www.cnbc.com/id/38565740/Google_s_Eric_Schmidt_Kicks_Off_Techonomy_Conference, accessed on 16 Jul 2012.

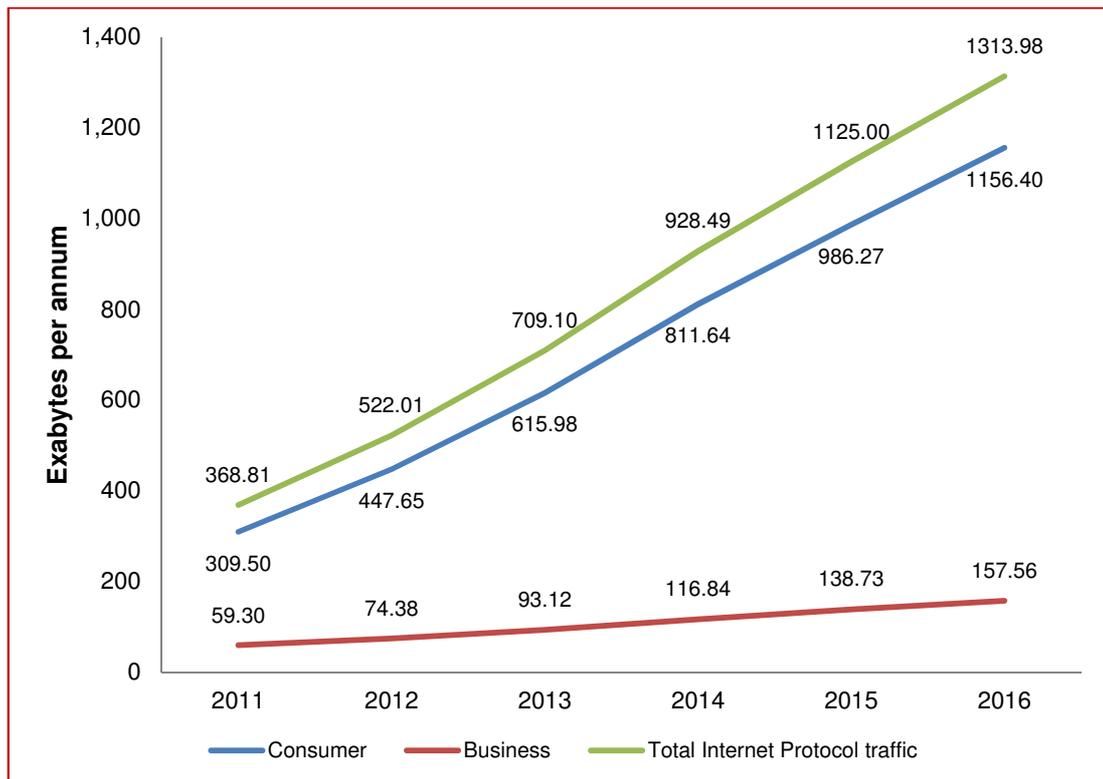
³ Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C. and Hung Byers, A. (2011), *op. cit.*

⁴ Yiu, C. (2012), *The Big Data Opportunity: Making Government Faster, Smarter and More Personal*, London: Policy Exchange.

⁵ Cisco (2012), *Cisco Visual Networking Index: Forecast and Methodology, 2011-2016*, San Jose, CA: Cisco Systems, Inc.

cases accumulation, of data is a fact of life, forward-thinking organisations will find ways to turn this (almost) free property into gold. Although the volume of data created will probably increase at least five-fold over the next five years, precious little of the information generated today is meaningfully organised or strategically deployed for organisational advantage. About a quarter of executives admit the bulk of their organisations' data are untapped, while slightly more than half confess to using only about half of their valuable data.⁶

Figure 1: Global Internet Protocol traffic, by segment and total, 2011–2016



Source: Chart developed from data in Cisco (2012), *Cisco Visual Networking Index: Forecast and Methodology, 2011–2016*, San Jose, CA: Cisco Systems, Inc.

Enter analytics

Business leaders, however, increasingly view data as an important driver of innovation and a significant source of value creation and competitive advantage, instead of merely as an organisational reality to cope with. To get the most out of an organisation's data – particularly if this involves datasets of gargantuan sizes – a more sophisticated way of

⁶ Economist Intelligence Unit (2011), *Big Data: Harnessing a Game-Changing Asset*, London: Economist Intelligence Unit.

handling, managing, analysing and interpreting data is necessary. This calls for the proactive and creative use of analytics to capture the potential of innovation afforded by data and to gain competitive advantage.

Analytics is the practice of using data to generate useful insights that can help organisations make better fact-based decisions with the ultimate aim of driving strategy and improving performance. It integrates capabilities in data management, technology, systems and automation, applications and institutional skills to enable organisations identify existing issues and predict future trends, opportunities and threats. Touted by some as a natural evolution of business intelligence (BI), which is predominantly concerned with historical analysis, analytics goes further by building on BI's hindsight to derive insights that can inform current action and generate foresights to shape the future.

The application of analytics is wide and varied, and can cover potentially every aspect of an organisation and its business. For instance, analytics capabilities allow organisations to better add value to products and services by segmenting and targeting consumers more effectively (consumer analytics), adjust price points to optimal levels more quickly in response to changes in the market (pricing analytics), improve performance and change management processes (performance/HR analytics), and be more agile in allocating and redeploying resources to capture first-mover advantages in specific market segments (financial/resource analytics).

Although many organisations already have some form of BI capabilities embedded within those areas, advanced analytics is sought after for its speed, modelling capabilities and analytical and predictive power – pivotal issues in the era of big data. A well-designed analytics architecture helps reduce information latency, thus equipping leaders with the most comprehensive insights derived from up-to-date information to make decisions on complex risk scenarios. It is also capable of automating low-risk analytical and decision-making processes, hence giving leaders more time to focus on high-stakes issues.

While there may be plausible arguments for the value of an experienced leader's intuition and gut-feeling, evidence points to the greatly enhanced outcomes analytics can offer. More than half of organisations that use data most effectively outperform their peers financially.⁷ Organisations that have aggressively deployed analytics are twice as good at predicting outcomes and three times as good at predicting risk as those that haven't.⁸ Empirical studies show that organisations that employ "data-directed decision-

⁷ *Ibid.*

⁸ Bisson, P., Stephenson, E. and Viguerie, S.P. (2010), "The productivity imperative", *McKinsey Quarterly*, June.

making” see a 5–6% boost in productivity,⁹ while those using business information and analytics to differentiate themselves from competitors are twice as likely to be top performers as lower performers.¹⁰ Organisations in a variety of industries, including well known American brands P&G and JC Penney, have gained competitive advantage by using data analytics for decision-making.¹¹

Organisations increasingly realise that the uses of analytics are extensive and growing, above and beyond diagnostic and predictive purposes. It also enables organisations to harness the power and potential of data to spawn innovative products and services. Capital One, a Fortune 500 financial services institution, for example, uses analytics to continuously experiment with innovative combinations of customer segments and new products. E-business pure plays such as Google, Amazon and eBay have long used insights generated from data to innovate their services and configure their offerings to an individual’s preferences.

Fuelled by advances in information and communication technologies and the digital revolution, there are boundless new opportunities that can be captured by applying insights gleaned from data. The following five trends suggest what analytics might hold for innovation and competitive advantage in the near future.

Trend 1: An avalanche of applications and services derived from open data

With the European Commission launching an Open Data Strategy for Europe and the UK Government committing to further opening up a range of public data to stimulate the economy,¹² a host of new consumer mobile and web applications developed by using data previously held in the public sector is expected to flood the market.

These Actionable Analytical Applications, or A³, will not only widen the apps market but also redefine the apps architecture with enhanced visualisation, usability and interactivity. Mobile platforms – primarily smartphones and tablets – will provide readily available user interface. Annual global mobile data traffic flows are expected to jump

⁹ See for example, Brynjolfsson, E., Hitt, L.M. and Kim, H.H. (2011), “Strength in numbers: how does data-driven decisionmaking affect firm performance?” available at <http://dx.doi.org/10.2139/ssrn.1819486>, accessed on 13 Jul 2012.

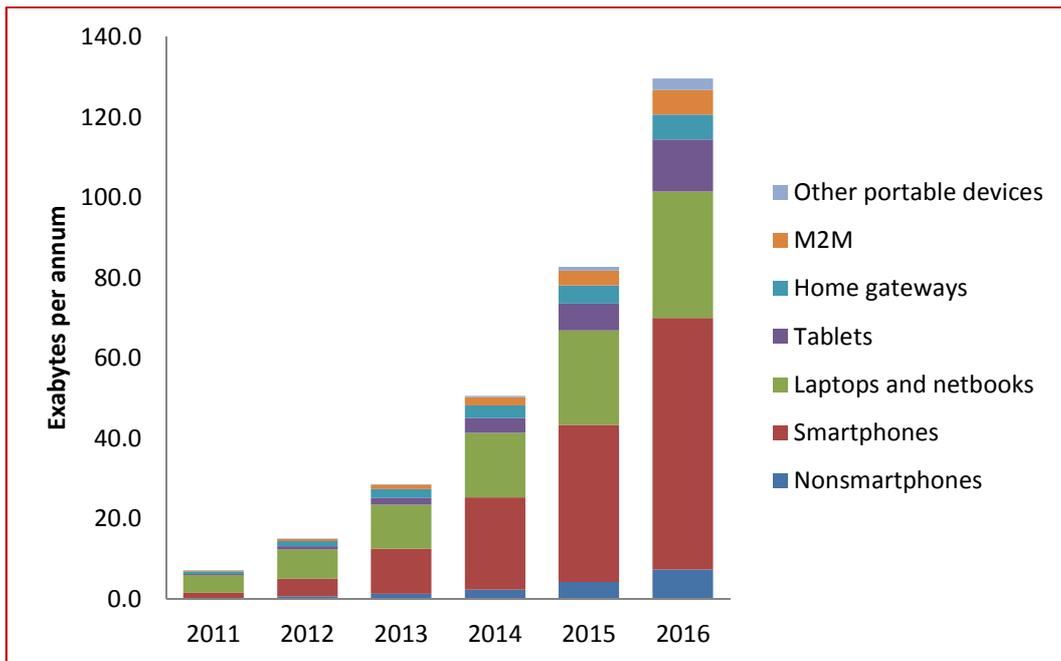
¹⁰ LaValle, S., Hopkins, M.S., Lesser, E., Shockley, R., and Kruschwitz, N. (2010), “Analytics: the new path to value”, *MIT Sloan Management Review*, 52(1): 1-22.

¹¹ Davenport, T.H. and Harris, J.G. (2007), *Competing on Analytics: The New Science of Winning*, Cambridge, MA: Harvard Business Press.

¹² The Government recently set out what citizens, businesses and the public sector can expect from the unlocking of the benefits of open data in HM Government (2012), *Open Data White Paper: Unleashing the Potential*, London: The Stationery Office. Each government department is required to publish an Open Data Strategy, setting out what data will be released over the next two years.

from 15 exabytes this year to 130 exabytes by 2016.¹³ Advanced visualisation capabilities will no longer be the staple of only consumer mobile platforms, but will also make the leap into enterprise analytics. This will be made possible by Web 3.0, featuring technologies capable of creating datasets that can be intelligently combined – also increasingly known as ‘smart data’.

Figure 2: Global mobile data traffic, by device type, 2011–2016



Source: Chart developed from data in Cisco (2012), *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2011-2016*, San Jose, CA: Cisco Systems, Inc.

The potential benefits of open public data to the economy as a whole are sizeable. The UK Government estimates that public sector data is worth £16 billion,¹⁴ while the EC believes open data can deliver a €40 billion boost to the EU economy each year.¹⁵ At the time of writing, 8,658 datasets are already available on data.gov.uk, ranging from information on real-time traffic congestion and crime levels to NHS clinical outcomes and school spending and performance.

These developments offer gilt-edged opportunities for innovation. Apps and content developers and information services providers should seize on these opportunities to turn data into gold by developing innovative apps and services that could not previously

¹³ Cisco (2012), *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2011-2016*, San Jose, CA: Cisco Systems, Inc.

¹⁴ “Government opens up more data for free”, *BBC News*, 30 Nov, available at <http://www.bbc.co.uk/news/technology-15966688>, accessed on 16 Jan 2012.

¹⁵ “Digital Agenda: Turning government data into gold”, European Commission press release, 12 Dec 2011, available at <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/1524&format=HTML&aged=0&language=EN&guiLanguage=en>, accessed on 16 Jul 2012.

have been conceived when data were proprietary. For instance, we can expect to see an increasing number of traffic-related apps aimed at helping commuters optimise routing and adjust their travel plans in the light of actual or imminent congestion. These can be mashed up by combining real-time traffic and roadworks information with interactive maps. Localised real-time weather information and the latest forecast with greater accuracy can be combined with corresponding technical advice to help farmers optimise their farming operations, just like what Thomson Reuters, through its Reuters Market Light service, offers Indian farmers.

Box 1: Open data and innovative apps in New York City

New York City is an interesting example of how the opening up of public data has spawned a string of innovative apps that has transformed the way New Yorkers live, work and play. Through its NYC BigApps Competition, the New York City Economic Development Corporation and the Department of Information Technology and Telecommunications collaborated with about 30 agencies to make available more than 170 datasets, including those on census data, extensive property valuation and assessments, restaurant inspection results, side parking and traffic updates, and locations of all sidewalk cafés, laundry facilities, playgrounds and dog runs.

The Mayor, Michael Bloomberg, challenged developers to create apps based on the data: “The information we’re providing is the public’s, and we’re relying on the creativity and talent of New York City’s tech and entrepreneurial communities to come up with innovative and helpful ways to use it. It’s a great example of a 21st century public-private partnership.”

The initiative has seen innovative apps such as Zoner, which enables the user to calculate the maximum buildable floor area for a property in just seconds; Park.it, a real-time service that guides users to parking sweet spots and connects strangers to share unused and underused parking spaces; Help Me I’m Sick NYC and Emergency NYC, both of which help find the healthcare options that apply to the user’s situation and needs; and Work+, which helps users find places in the community that are good for working, based on users’ own criteria such as desired quietness, WiFi connectivity and availability of coffee.

Sources: NYC BigApps 3.0 website, <http://2011.nycbigapps.com/>, accessed on 16 Jul 2012; “Mayor Bloomberg and Deputy Mayor Lieber Launch NYC BigApps Competition”, New York City Mayor’s Office press release, 6 Oct 2009, available at http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2009b%2Fpr440-09.html&cc=unused1978&rc=1194&ndi=1, accessed on 16 Jul 2012.

Other innovative apps and services that are likely to be spawned include more detailed address-level house price comparison tools that include value-added information such as historical prices, council tax bands, energy efficiency ratings, local crime rates and local school Ofsted ratings; live collated information currently obtainable only on NHS Direct, such as real-time availability of places at local NHS dentists; and other specific but anonymised healthcare information. The latter can potentially be of much

commercial as well as social value. For example, France Telecom's Orange offers, in collaboration with healthcare providers and a medical devices company, services that monitor diabetics and cardiac patients remotely. These are expected to be increasingly common offerings, as are services and applications that allow for increased personalisation.

The spawning of innovative apps and services based on open public data can be useful not only for the consumer market but also for organisations seeking to use a combination of disparate information to optimise their operations, and thereby enhance their competitiveness through greater efficiency. Manufacturing and retail firms – especially those that cannot afford sophisticated enterprise-wide analytics architecture – will benefit from enhanced mash-ups of weather, traffic, commodities prices and local Jobcentre Plus labour market information.

Trend 2: Gradual opening up of data in the private sector

The private sector has traditionally been relatively more reluctant and sluggish in opening up what are seen as proprietary datasets to developers and third parties. According to a survey, although the majority of organisations are keen on the government's open data initiative, 68% would not be prepared to open up access to their own data despite recognising the commercial benefits data sharing could bring.¹⁶ Organisations' concerns range from privacy and accountability issues to intellectual property protection and quality of data management.

However, with the increasing importance of highly networked and open source business models and advancements in analytics capabilities that help mitigate some of these concerns, organisations are beginning to follow the government's lead. Insurance firms are among the early adopters of the open data paradigm, primarily with the aim of sharing information on fraudsters. While incorporating predictive models into the claims processing system might help flag up claims with a high probability of fraud, by sharing intelligence within the industry firms are able to learn the breadth of tricks fraudsters can employ to make false claims.

For most organisations, the *raison d'être* for sharing data lies in the enhanced ability to serve customers better, which of course translates into the likely increase in market share and competitive advantage. This is particularly important for organisations operating with highly networked supply and distribution chains. Customers rarely bother about the relationships behind the scenes among network members or the inner

¹⁶ "Businesses unwilling to share data, but keen on government doing it", *The Guardian Online*, 29 Jun, available at <http://www.guardian.co.uk/technology/2010/jun/29/business-data-sharing-unwilling>, accessed on 16 Jul 2012.

workings of the ecosystem. But what goes on behind the scenes is absolutely integral to the delivery of an end product or service to the customer. By sharing crucial information and best practices, network members are able to configure their respective operations more optimally and efficiently to ensure the customer is well served. This had indeed been one of the more positive and successful features of the Japanese vertical *keiretsus*.

There is also a growing trend of organisations sharing data for the purpose of innovation. Created in consultation with regulators, the Coalition Against Major Diseases in the US is a collaboration that involves pharmaceutical giants including the likes of GlaxoSmithKline, Pfizer, AstraZeneca and Novartis sharing data on thousands of Alzheimer's and Parkinson's patients. By pooling resources from clinical trials and sharing a database covering thousands of patients, scientists can hunt trends that will spark new and innovative ideas for treating neurodegenerative diseases.¹⁷ Regulatory frameworks permitting, such data sharing collaborations are poised to become commonplace in the UK, especially as organisations increasingly seek to reap the benefits of open innovation.

While grouses emanating from organisations understandably revolve around stringent data protection laws that may impede greater data openness, there are also legitimate concerns that the sharing of certain sensitive data, such as pricing information supplied by competitors to insurance brokers, can lead to anti-competitive practices. The challenge ahead for regulators is clearly to demarcate the boundaries within which data sharing among organisations can bring about positive economic and social benefits without breaching consumer privacy and distorting the market. Given that open data is the way forward, key implications for organisations include determining what, with whom and how data should be shared. In addition, pertinent questions on the horizon will be asked of what advanced analytics capabilities are required to enable and facilitate the optimal sharing of data.

Trend 3: Open source and platforms are the way forward

As recently as just five years ago, tapping into the creativity of multiple external parties or users was hailed as an ingenious way to innovate. It is, however, fast becoming an imperative for organisations wishing to generate a wider amount of useful data and contextually rich insights, or to create applications, products and services faster and

¹⁷ See Romero, K., De Mars, M., Frank, D., Anthony, M., Neville, J., Kirby, L., Smith, K. and Woosley, R.L. (2009), "The Coalition Against Major Diseases: developing tools for an integrated drug development process for Alzheimer's and Parkinson's diseases", *Clinical Pharmacology and Therapeutics*, 86(4): 365-7; and Critical Path Institute website, available at <http://www.c-path.org/camd.cfm>, accessed on 17 Jul 2012.

more effectively. Although the open innovation concept has been around for nearly a decade,¹⁸ many organisations have found it challenging to put into practice. Until recently, innovation has always been conceived as a domain of in-house R&D departments, with the involvement of external parties usually being formalised in inter-organisational joint-ventures or alliances. The idea of picking from an exclusive pool of in-house brains has now shifted – and will continue to shift even more markedly – to tapping into a world of talent.

Collaborative networks have since become a prevailing trend. Thanks to the enabling power of technologies, data can now be generated and obtained – and by extension, collaborative innovation spawned – from virtually any willing sources, including previously unimaginable ones such as consumers, suppliers and competitors. The internet and other digital technologies have catapulted co-creation into the mainstream. While just two years ago Cisco estimated traffic flows over the internet would reach 667 exabytes by 2012,¹⁹ the estimate has now been revised to 709 exabytes.²⁰ The vast amount of data that is shared over cyberspace is continuing to revolutionise analytics and add a new dimension to organisational decision-making.

The concepts of open source and open platforms enable collaboration at scale, and hence the proliferation of big data through large-scale crowdsourcing. Engaging with the wider community via platforms such as social media enables organisations to obtain important insights that would have otherwise been missed through narrow information gathering channels. For instance, as more than 68 million bloggers worldwide post reviews and recommendations about products and services, hoteliers are well positioned to gain insights into the after-effects of a bad experience in a disgruntled guest's social networks. Organisations can sometimes find out more about themselves when they consider the view from the outside.²¹

The Ford Motor Company, PepsiCo and Southwest Airlines are among organisations that analyse postings about them on Facebook and Twitter to gauge the immediate impact of their marketing campaigns and to feel the changing pulse of consumer sentiments about their brands.²² Instead of taking months to arrive at decisions, or model hypothetical scenarios, Amazon simply asks customers regarding choices of service features or a more efficient check-out process. An answer could be obtained in

¹⁸ Although inter-firm collaboration in R&D can be traced back nearly half a century, the idea was only formally conceptualised as "open innovation" by Henry Chesbrough about a decade ago. See Chesbrough, H.W. (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Boston: Harvard Business School Press.

¹⁹ Quoted in The Economist (2010), "Data, data everywhere", Economist.com, 25 Feb, available at <http://www.economist.com/node/15557443>, accessed on 17 Jul 2012.

²⁰ Cisco (2012), *Cisco Visual Networking Index: Forecast and Methodology, 2011-2016*, op. cit.

²¹ When sharing his thoughts on some management lessons learned, Sir Terry Leahy, the former Tesco CEO, said at the CIPD Conference 2011 that the "truth" often lies outside the organisation, and that it is the role of the leader to seek it out.

²² Bughin, J., Chui, M. and Manyika, J. (2010), "Clouds, big data, and smart assets: Ten tech-enabled business trends to watch", *McKinsey Quarterly*, Aug.

real-time, or sufficient data could be generated within hours to reveal a statistically significant difference.²³ The public sector, too, stands to benefit hugely from crowdsourcing. Local authorities, for example, are able to deploy services much more quickly by obtaining information on FixMyStreet.com, where the public report and discuss local problems, such as fly-tipping and vandalism.

Box 2: Insights from customers matter

If findings from studies conducted by Consumer Focus are anything to go by, gleaning important insights from customers' comments and feedback has never been more important for organisations where continuous improvement and open innovation are a way of life.

The value of feeling the pulse of consumer sentiments is crucial, particularly when more than two-thirds of consumers say they trust other consumers' reviews and feedback more than a company's official line. While in 2006 some 73% told others about a business they trust, in 2009 86% normally spread the word on a particularly good experience with a company, a figure that rose again to 94% the following year. In 2006 68% admitted they had punished a distrusted company by speaking critically of it, while in 2010 96% told others of a particularly bad experience with a company.

Owing to the ever expanding popularity and uses of social media, the amount of data from which consumer insights may be distilled is growing exponentially. UK consumers are leaving well over 100 million comments a year on service performance. This is where crowdsourcing and big data potentially intertwine, and thus necessitates the deployment of advanced analytics.

Source: Cullum, P. (2010), *Unleashing the New Consumer Power*, London: Consumer Focus.

The trend of applying modern analytics capabilities to open source platforms hasn't just been driven by the need to make better or quicker decisions based on newly captured consumer insights. Powerful analytics capabilities are increasingly enabling open innovation. For example, by using constantly evolving mash-up technologies, innovative developers are able to aggregate and reconfigure open content to develop new services, or to simply glean new insights that feed into the incubation of upcoming technologies. Language translators and news feeds are two common, and by now rather dated, examples of open-sourced services. In recent times there has been a mushrooming of geolocation applications such as Feedjit, which tracks the location of web activities, and enhanced global positioning systems, both of which make good use of data from open sources and mash-up technologies.

Open source techniques have enabled the creation of new or better products and

²³ Brynjolfsson, E. (2011), "ICT, innovation and the e-economy", EIB Papers 8/2011, European Investment Bank, Economics Department.

services. Crowdsourcing has been instrumental in spawning OpenOffice, the Oxford English Dictionary and Wikipedia. Facebook made full use of its community for product development by recruiting some 300,000 users to translate its site into 70 languages. Remarkably, it took just a day to translate the site into French. Park.it is a crowdsourced, mobile-based app that has proven popular in helping New Yorkers find the right parking spaces at the right hours. There are no signs that this trend of innovation is likely to abate in the near future – if anything, it is likely to define the way organisations innovate in the future.

As the open source trend continues to grow, it gives rise to a number of implications. The future is clearly the network – no organisation will be able to thrive in an increasingly networked global economy by merely relying on internal capabilities. The challenge for organisations is to look beyond the entity itself for ideas and insights and to consider how to better harness the creativity and ingenuity of stakeholders in their networks to innovate and build competitive advantage. There will, however, be genuine concerns regarding intellectual property. The challenge going forward in this area is for the state and businesses to work together towards reforming the intellectual property rights framework to enable open innovation to flourish.

Analytics technologies themselves will follow the open source trail. It is increasingly obvious that open source analytics software, such as the currently popular offerings Apache Hadoop and R, will become commonplace and will disrupt the incumbent, closed-source, expensive, on-premise vendors. With the amount of data shared over open platforms expected to increase exponentially, greater analytics capabilities will become essential for generating key insights and to reconfigure information in ways that can spawn innovation.

Trend 4: Proliferation of unconventional data

Numerical data has long been the staple feed of analytics and the basis on which business leaders make informed decisions. Advanced analytics of the future will see the increasing prominence of unconventional, also known as unstructured, data. These can appear in various forms, such as text, captured dialogues or conversations, and videos, and will only add to the complexity of big data.

While in the past quant buffs might have balked at using anything but numerical data in order to preserve analytical rigour and objectivity, there is increasing appreciation of the rich contextual information that only unstructured data can offer. Significant predictive insights can now be gleaned by using text analytics offered in advanced solutions that integrate both structured and unstructured data. For example, notes regarding poor performance or misconduct charges may not be found in most structured data, but are

nonetheless vital information in the handling of an employee's compensation claim. In a bid to inform and improve its recruitment process and outcomes, the Bon-Ton Stores in the US applied HR analytics to unstructured data in order to identify the attributes of successful cosmetics sales representatives. Since 2008, the chain has seen an increase of US\$1,400 in sales per rep and a 25% decrease in employee turnover.²⁴

The ability of advanced analytics to combine unstructured data and predictive algorithms will see the increasing use of event-driven architectures to spawn innovations. Complex Event Processing (CEP), for instance, enables value to be captured from real-time data and intelligent decisions to be auto-generated instantaneously. By relying on inference or rule-based reasoning technology, CEP is able to use unstructured data to infer or predict an event and model and analyse its potential impact. Ford's Low Speed Safety System and Forward Alert, developed using CEP to automatically intervene to prevent potential low-speed collisions in urban driving, have made the automobile giant the industry leader in safety technology. Self-driving cars of the future will be built on similar analytics technologies.

NYCFacets, a resource for other developers and winner of this year's NYC BigApps Competition, is another example of innovation spawned from using advanced analytics to make sense of structured and unstructured data. NYCFacets is an application that seeks to streamline the process of accessing and utilising New York City's Open Data Portal. By using a combination of semantics, statistics and 'crowdknowledge', it functions as an open data mash-up portal that can collaborate structured and unstructured data, enabling users to make intelligent, federated queries on the city's exponentially increasing amount of data and mash it up with other public and private data sources.²⁵

The importance and value of insights that can be derived from unconventional types of data are increasingly acknowledged. The challenge for organisations is two-fold: to build and deploy the appropriate advanced analytics capabilities to glean insights from a powerful combination of structured and unstructured data, and to harness the potential for innovation that unconventional data offers.

Trend 5: Convergence of information architecture

Although an increasing number of organisations have begun making better use of their data, analytics capabilities have often been focused on several highly targeted areas,

²⁴ Gardner, N., McGranahan, D. and Wolf, W. (2011), "Question for your HR chief: Are we using our 'people data' to create value?", *McKinsey Quarterly*, Mar.

²⁵ NYC BigApps 3.0 website, <http://2011.nycbigapps.com/>, accessed on 16 Jul 2012.

usually for understanding and predicting consumer behaviour and for financial modelling. The interconnectedness of organisational functions and the complexity of the ecosystem (economic, environmental, social, political) mean analytics must now mirror the complex realities of business and integrate different variables into the equation.

From their roots in highly siloed systems, the disciplines of performance, risk and compliance management are now converging into an integrated framework of enterprise-level strategy and governance. This has been driven in part by the acknowledgement that risks must be assessed in the context of an organisation's strategy and performance objectives, while compliance should be based on an organisation's risks. Similarly, attempts to predict customer purchase behaviour can no longer be done in isolation from a number of other key related variables such as interest rates, expected inflation, consumer confidence, environmental legislation, anticipated competitor offerings, supply chain disruptions, volatility of foreign markets, sales personnel performance, advertising spend and even the weather.

The source of competitive advantage can be found in an organisation's ability to holistically assess the various fragmented information available so as to make informed decisions. 'Real analytics' may be the answer going forward. It refers to the complex convergence of information management, performance improvement and advanced analytics that requires an appropriate enterprise-wide information architecture to support it. Real analytics capabilities enable organisations to amalgamate disparate data and filter their enormous amount in order to make sense of data 'noise', model the potential impact on specific outcomes and distil key insights to inform decisions. It will push analytics capabilities deeper into an organisation and will become an institutionalised norm for decision-making. Such advanced analytics capabilities are made increasingly possible by modern computing power that doubles approximately every 18 months.²⁶ Against such a backdrop, it is hardly surprising that the likes of IBM, Microsoft, Oracle and SAP have spent billions in the past few years acquiring software developers in the field of advanced data analytics in anticipation of a surge in demand for sophisticated enterprise-wide information architectures.

This convergence presents several implications for organisations. Many have already invested heavily in bespoke information management, performance management and IT systems. While these may serve their specific purposes very well, organisations need to start thinking of gradually moving towards a meta-system, or architecture, that can provide an integrated enterprise view of these inter-related functions. Parallel to this is the need to acquire and develop the right talent and institutional skills to analyse and interpret information and to strategically turn hindsight and insight into foresight.

²⁶ This is based on Moore's law, which is now somewhat a truism in the computer industry. Intel co-founder Gordon Moore first observed that transistors on a chip would double every year, before recalibrating it in 1975 to every two years. David House, a then Intel executive, noted that this would cause computing performance to double every 18 months. See Moore, G.E. (1965), "Cramming more components onto integrated circuits", *Electronics*, 38(8): 114-7.

It's more than just technology!

Organisations have historically invested heavily in technology and technological solutions for the purpose of managing and analysing data. Some, in anticipation of future battlegrounds, have gone a step further by putting in place expensive analytics technologies. Herein lies a potential pitfall – technology alone is unlikely to deliver the holy grail of predictive insights that trump competition, or the market-making innovations that define an organisation. Leaders and executives who are increasingly relying on complex data analysis for decision-making and innovation must not lose sight of at least six other key considerations.

The most important of these is the alignment between analytics capabilities and business needs. Data and analytics must therefore take on a **strategy-level orientation**. As much as analytics is used to drive strategy (particularly competitive strategy), analytics capabilities must support board-level strategy and the overall business model. Trying to force square pegs into round holes is a waste of precious resources. If the organisation's business model is based on cost leadership (e.g., low cost airlines), an appropriate, strategically-aligned analytics architecture might help predict raw material prices (e.g., fuel prices) and innovatively structure alternative purchasing options (e.g., fuel hedging configurations), not one that yields new configurations of a premium service, no matter how innovative that may appear to be.

Hitherto, organisations have mostly deployed analytics capabilities in highly targeted areas – customer, pricing and finance being, understandably, the most popular silos. In order to gain a holistic view of the organisation's value creation activities and its external environment, it is necessary to, at least incrementally, push analytics capabilities deeper into all areas of the organisation. An analytics architecture that **integrates all areas of the organisation** is capable of delivering more accurate and comprehensive predictive insights and minimises the possibility of missing out on important variables and their effects.

Closely related to the above two considerations is the need for the **CEO to drive the adoption of analytics across the organisation**. Without a champion of fact-based decision-making encouraging, nudging and cajoling the entire organisation to embrace the potential of data and apply the analytics capabilities available, attempts to institutionalise analytics as the standard process for decision-making, or to exploit data for innovation, may turn out to be half-baked, futile exercises.

Organisational alignment – structure, processes and culture – is another key consideration vital for successfully embedding analytics capabilities in the organisational fabric. The use of data and the deployment of analytics for decision-making must cut across internal boundaries in order to yield the best results. This, however, goes against

the grain of an organisation and can easily create friction, largely because the notion of 'organisation' itself reinforces silos and subconsciously dissuades members from freely and seamlessly sharing information. Without the right structure and processes, these silos will only be further strengthened. The lack of a culture that promotes exploration and experimentation (with a sensible 'allowance to fail' built in) might curtail the potential of spawning innovation from data.

Investment in analytics capabilities must go beyond merely procuring the right technological solutions and systems. It must also involve acquiring and developing the **right talent and institutional skills** to analyse and interpret data, distil and apply insights from data, and constantly explore and think laterally to extend the possibilities of innovation afforded by data. In many organisations there isn't a shortage of useful data but the ability to extract wisdom and insights from them. While in the past quantitative analysts were largely responsible for anything to do with data, today many more data users ought to be equipped with a range of data, predictive and interpretive skills, in tandem with the expansion of data applications and uses. It should not come as a surprise when an increasing number of organisations accord greater prominence to the Chief Information Officer's role in strategic decision-making.

And finally, organisations must adopt a **paradigm shift** in order to fully capitalise on the opportunities afforded by data in an era where open data and open innovation are more than just buzzwords. Looking beyond the walls of the organisation for data and information is of increasing and critical importance, as is building meaningful networks with stakeholders. While the interpretation and application of data will remain proprietary, it is likely that the majority of data, insofar as they are privacy- and security-proof, will be thrust into open platforms. The best analytics technologies will only be useful if they can feed on a larger and wider pool of data.

In need of a 'booster'

Data used to be the boring stuff, and analysing them a specialism of technically-trained statisticians, often unfairly stereotyped as data geeks. Increasingly, big data is becoming the next frontier of competitive advantage. Part of this is down to the realisation that many traditional sources of competitive advantage, though still relevant and pivotal, are reaching a point of saturation and are beginning to lose their distinctiveness that initially served as key differentiating factors for organisations.

Owing to present day mobility of human and financial capital, most large organisations can gain access to the same pools of talent and pots of investment. Thanks to the speed and scope of knowledge dispersion in the modern economy, leaders are quickly able to learn the latest best practices in the industry, or receive expert advice from an

ever growing cadre of consultants. Organisational core competencies and resources are in need of a 'booster' to give them a new lease of life. Harnessing the 'booster' potential of data to complement, and in many cases even augment, existing sources of competitive advantage is the key going forward.

Although what is considered as big data may vary from sector to sector and organisation to organisation – it can range from a few dozen terabytes to multiple petabytes – the key is not to agonise over the amount of data but to consider the appropriate tool to breach the frontier. These trends have highlighted how analytics can be the tool that organisations deploy to take full advantage of data in the quest to make decisions that drive strategy and performance more effectively and to spawn innovative products and services. While diagnostic and predictive outcomes are the most sought after benefits from building and deploying analytics capabilities, forward-thinking organisations are looking beyond just the traditional concerns of data and decisions. Many are beginning to spot innovation opportunities and niches by unleashing not just the analytical but also the creative power of advanced analytics on big data to meet latent market needs with new, or improved, products and services.

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