THE CENTER
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HUNTON & WILLIAMS LLP

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Testimony of Martin E. Abrams
Executive Director
Center for Information Policy Leadership
Hunton & Williams LLP

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Senate Committee on Commerce, Science, and Transportation
Subcommittee on Interstate Commerce, Trade and Tourism

Distinguished Chairman, honorable committee members, I am Martin E. Abrams, Executive Director of the Center for Information Policy Leadership. I am honored to testify on information policy, and the opportunities and risks to maintaining a safe marketplace for American consumers raised by new developments in the information economy.

The Center for Information Policy leadership was founded in 2001 by leading companies and Hunton & Williams LLP. The Center was established to develop innovative, pragmatic solutions to privacy and information security issues that reflect the dynamic and evolving nature of information intensive business processes and at the same time respect the privacy interests of individuals. Since its establishment, the Center has addressed such issues as conflicting national legal requirements, cross-border data transfers, and government use of privacy sector data, with a view to how the future direction of business practices and emerging technologies will impact those issues.

The Center and its forty-one member companies believe that difficult information policy issues must be resolved in a responsible fashion if we are to fully realize the benefits of an information age. Center experts and staff, however, speak only for themselves. My comments today reflect my views, and do not necessarily reflect the views of the Center's member companies, Hunton & Williams LLP, or any firm clients.

I. Summary

The Federal Trade Commission is charged with many responsibilities as it carries out its mission of maintaining a safe marketplace for American consumers. The Center has been privileged to work with the FTC on issues related to consumer protection and information policy development, and my comments today focus on that aspect of the Commission's work.

The FTC is to be applauded for undertaking serious work to helping policymakers and the public understand issues around information privacy and security and for its thoughtful, rigorous enforcement that improves the safety of the digital marketplace. The FTC has taken on complex, fast-emerging issues and taken important steps to address those issues through policy development and consumer education. Going forward, however, information privacy and security issues will only become more complex and surface more quickly.

- The FTC must be equipped to address issues related to information security and privacy that are more challenging than ever. Emerging technologies for data collection, rapid advances in business analytics, and the international nature of data flows challenge traditional frameworks of governance and make new demands on enforcement mechanisms.

- FTC's role in enforcing legal requirements for privacy and information security remains critical. Moreover, to foster consumer trust, the FTC must be prepared to undertake oversight of alternative methods of enforcement that respond to immediate consumer complaints regarding information use and resolve consumer disputes with companies.

- The FTC activity in development of information policy internationally is key to the protection of American consumers in the global marketplace. The Commission's work in this area should be recognized and supported.

Congress' Reauthorization of the FTC should specifically acknowledge the growing importance of the Commission's information policy development mission, and fund its expansion to match the complexity of the information marketplace. As part of that mission, it should encourage FTC work on alternative mechanisms to address consumer disputes related to information misuse as an adjunct to its traditional enforcement role. Congress's Reauthorization should recognize and encourage the FTC's prominent role in international information policy development. Having charged the agency with this mission, Congress should also provide oversight to ensure that it is successfully carried out.

II. The FTC must be equipped to address increasingly complex and challenging issues related to information security and privacy that arise from rapid developments in technology, business analytics and international data flows.

The Commission plays a key role in the enforcement of laws governing the privacy and security of information and in the development of forward-looking public policy - both domestically and internationally - to address emerging information governance issues. The FTC has done an admirable job in helping policymakers and the public understand and respond to issues surrounding information privacy and security through its enforcement actions and through its extensive work in workshops, requests for comments and hearings to explore how best to act on these questions. It has provided clear guidance to the market while still allowing time for the market and self-regulation to respond.

In this role, the FTC has taken on difficult issues related to companies' compliance with privacy policies, data security and data breach, emerging technologies such as RFID, and how to write privacy notices that effectively communicate to consumers.

The complexity of these issues, however, will pale in comparison to those on the horizon, when digital personally identifiable information is ubiquitous, the marginal cost of collecting and aggregating it approaches zero, and society relies even more heavily on it for business, government, education, and health care.

This complexity is driven in large part by three developments: the emergence of new technologies for data collection, the rapid advances in business analytics, and the international nature of data flows.

A. The Emergence of New Technologies for Data Collection

The collection of information about people is not new. Companies have collected data by phone, at points of sale, online, and through credit applications. Public record information collected and sorted by the government is used by companies; businesses and organizations also purchase information compiled by other companies about consumers.

New data collection technologies, however, dramatically change the way and the places from which information about consumers is gathered. They vastly increase the amount of information available to businesses. Radio devices such as mobile telephones, global positioning systems, radio frequency identification tags and wireless sensor networks collect information about an individual's location, and often their activity when they are at that location. Data accessed through search engines from social networks identify relationships between people, their interests and other individuals. Information collection often occurs in ways that do not involve the active engagement of the consumer, through highway toll tags, keystroke monitoring, and security cameras.

In many cases these technologies make it unnecessary for businesses to engage in collection, compilation and organization of data as we traditionally think about it. Rather, information can be immediately useful as it is accessed through the search of online, publicly available resources and websites. The search, matching and use of this information can occur dynamically and in real time.

This ability to gather information in new environments, in real time, and without consumer engagement significantly changes the interaction between the data collector and the individual, and strains our traditional notions of how best to protect the privacy interests of individuals in information that pertains to them. Increasingly the FTC will need to understand this new dynamic and to consider creative, more effective approaches to protecting the consumers' interest in the privacy of their personal information.

B. The Rapid Development of Business Analytics

The application of analytics enables businesses to use information to create value. Business analytics includes data warehousing, data mining, business intelligence, enterprise performance, management and data visualization. The analysis applied by credit reporting organizations to the data they received was an early application of data analytics about people, allowing credit grantors to offer credit to consumers of more widely varied credit backgrounds while still managing and making appropriate decisions about risk.

Today, businesses of all sizes use information analytics to predict response, profitability, return visits, and price tolerance. Government agencies use analytics to predict risk and evaluate passengers for flight security and safety, and to manage fraud related to health care reimbursement.

In his paper, "The Future of Business Analytics," Bruce McCabe[1] describes a 10-year view of emerging analytics technologies and how they will impact industries, organizations and the workplace. The paper offers detailed predictions about the way in which we will analyze and use data to predict consumer behavior, enhance marketing, and meeting consumer needs. He predicts that analysis of the information gathered through location tracking devices will enable organizations to gain entirely new insights about their assets, staff, customers, and products. Analysis of information gathered through audio and video will quickly grow in importance. Business analytics systems will be able to take advantage of new algorithms to draw inferences from material in

[1] Bruce McCabe is the managing director of S2 Intelligence Pty Ltd, a company he founded in 2002 to research technology issues for Australian executives and policy-makers. Before founding S2, McCabe held senior research positions at Gartner and IDC. His paper, sponsored by Business Object Australia, is attached for the Committee's review.

discussion forums, customer feedback, and e-commerce and auctions sites, to infer overall positive or negative sentiment about companies and products.

McCabe asserts that analytic applications -- now only in their infancy -- will grow significantly because of three factors. First, the cost of technology will continue to go down as its power increases. Second, the volume of data available for analysis will continue to grow. Finally, unstructured data that is not usable today, such as digital pictures, will feed analytic engines as a result of improvements in natural language processing, search, inference and categorization.

C. The International Nature of Data Flows

Almost all business processes have become international. Consumer services are supplied out of India, accounts payable out of Costa Rico, software development is conducted in the Ukraine, and clinical trials are conducted in as many as twenty countries all at the same time. One global team meeting might require twenty professionals to all look at the same data sets originating from servers in twenty different countries. Industries as diverse as pharmaceuticals, automotive, software development and cosmetics all rely on global teaming and global sourcing. These business processes require massive flows of data across international borders in order to work.

All of this data must be protected from loss and alteration, and all of it must be used appropriately no matter where in the world it is accessed. The FTC has applied the Gramm-Leach-Bliley safeguards rule[2] to global sourcing whether managed by the company or outsourced to a third party company.

The Safe Web Act[3] passed by the last Congress gives the FTC authority to work with privacy enforcement agencies in other countries to protect American consumers. Criminals in other countries use the Internet to prey on American consumers, and the Safeweb Act gives the FTC the authority to pursue those criminals.

Because of the international nature of these data flows, the FTC must be involved in development of international frameworks for data protection. It must be empowered within those frameworks to protect American consumers when their data is overseas.

The FTC's international office and FTC Commissioners have also participated in meetings at the Asia Pacific Economic Cooperative (APEC) and the Organization for Economic Cooperation and Development (OECD). This will be a growing function for the FTC if the Commission is to effectively promote American interests in providing

[2] 15 U.S.C. § 6801 through 15 U.S.C. § 6809)

[3] Pub. L. No. 109-455

balanced protections for information and ensure that consumers have redress when their privacy has been compromised.

III. The FTC must continue its enforcement under Section 5 of the FTC Act, and begin to undertake an oversight role for alternative consumer complaint and dispute resolution mechanisms.

The FTC has a well deserved reputation in the United States and around the world as a tough enforcer of privacy and information security requirements. The Commissioner has used its power under the Federal Trade Commission Act,[4] as well as specific laws such as CAN-SPAM,[5] Fair Credit Reporting Act,[6] and the Gramm-Leach-Bliley-Act.[7]

This enforcement role is key to fostering consumer trust in the marketplace. Using its authority under these laws, the FTC protects consumers by enforcing the law against bad actors for their specific illegal practices. In doing so, it sends a clear message about appropriate business practices related to information privacy and security, encouraging the reliability and trustworthiness of the information marketplace. However, as a fairly small agency with limited resources, the FTC cannot investigate every occurrence of market abuse. Moreover, it has neither the authority nor the resources to resolve individual consumer complaints.

However, trust in the marketplace remains an important issue to consumers and critical to the health of the information-fueled market. Research conducted by Yankelovich in 2004[8] about consumer attitude toward industry information practices demonstrates that consumer trust in the information-driven marketplace is limited. At the core of these trust issues is the consumer's inability to resolve disputes about instances of misuse or mishandling of their personal information.

While the FTC is not the place to bring consumer complaints, it is well positioned to oversee market mechanisms to resolve consumer complaints about information practices. In the future accountability agents – entities to oversee business practices and assist consumers who are unable attain satisfactory resolution of complaints – will likely fill the gap of consumer dispute resolution. For example, industry safe harbors, will incorporate mechanisms not only to enforce safe harbor provisions, but also to resolve complaints

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[4] 15 U.S.C. §§ 41-51

[5] 15 U.S.C. 7701, et seq.

[6] 15 U.S.C. § 1681 et seq.

[7] 15 U.S.C. Sec. 6801-6809.

[8] Yankelovich, Re-building the bonds of trust: state of consumer trust, crisis of confidence Presented to: 10th Annual Fred Newell Customer Relationship Management Conference 2004 available at *www.compad.au/cms/prinfluences/workstation/upFiles/955316.State_of_Consumer_Trust_Report_-Final for Distribution.pdf.*

brought by consumers related to inappropriate use or failure to protect their information.[9] This new FTC role as a regulator of accountability agents could be substantially similar to the oversight of the Securities and Exchange Commission for self-regulatory bodies that enforce securities regulations.

This Commission's role is anticipated in the APEC Privacy Framework, adopted by APEC leaders in 2004. The APEC Framework calls for the transfer of data in the Asia Pacific region based on corporate cross-border privacy rules. Under the current vision for the Framework's implementation, rules would be approved by accountability agencies in the various APEC economies, including the United States. The FTC and other privacy regulating agencies in the United States would oversee these accountability agencies. In the context of the APEC discussions, the FTC has been considering how it would best execute that role.

IV. The FTC must continue its role in policy development, both domestically and internationally.

The FTC plays a key role in the development of effective, forward-thinking information policy in the United States and around the world. The FTC embraced this role when it held its first workshop on privacy-related issues more than a decade ago. Its domestic policy development work continues with its recent request for comments on the issue of public sector use of the Social Security number and the town hall meeting on behavioral marketing on the Internet scheduled for November 1 and 2.

While policy development is not explicitly articulated in the FTC Act as a role for the Commission, continued FTC involvement in this work is critical to the successful development of sound public policy and effective, efficient consumer protection related to information issues.

This policy development role is especially necessary as the United States and the world economy continues to move more deeply into an economy fueled, structured and motivated around the collection, use, analysis and sharing of information. This transition fundamentally challenges application of laws and regulations originally enacted to respond to the demands of an industrial economy and the early years of computerization. The FTC has become, and should continue to be, a key venue for development of policies to address new developments in the information economy.

The FTC has been significantly involved in the development of global processes to protect consumers in global markets. Just as data flows and valuable uses of data occur

[9] Accountability agents will likely be very similar to self-regulatory enforcement bodies that currently exist for securities regulation and that are overseen by the Securities and Exchange Commission.

across borders, criminals also can act regardless of national boundaries. The FTC has been actively participating in alliances to develop international governance structures for international data flows. Led by Commissioner William Kovacic, it works through the OECD Working Party on Information Security and Privacy (WPISP) to develop protocols to enable cooperation between law enforcement bodies of various countries to promote privacy protection. The FTC also works with the Canadian Federal Privacy Commissioner to foster cooperation with this leading trade partner.

Additionally, the Commission has been deeply involved in development of the APEC Global Framework. The FTC is an active participant in the APEC Data Privacy Subgroup, and part of the Subgroup's Working Party on Cross-border Privacy Rules. Ministers of APEC countries, including the United States, approved a project to develop protocols for approving corporate rules covering the transfer of data across borders just two weeks ago. Once developed, these mechanisms would protect American consumers as data that pertains to them moves throughout the Asia Pacific region. Under Commissioner Pamela Harbor's leadership, the FTC has taken a leadership role in developing these protocols, demonstrating to other APEC economies the serious commitment of the United States to ensuring the privacy and security of its citizen's data and the APEC Privacy Framework.

To facilitate these efforts, the FTC restructured its staff this year to merge all international activities into a common office that reports to the Office of the Chairman. The FTC's work in international forums should be acknowledged as part of the reauthorization and supported in future FTC budget requests.

V. Conclusion

The challenges raised by the fast approaching developments in the information economy cannot be met with yesterdays solutions. Protecting the privacy and security of consumers' information will require robust information policy that responds quickly and effectively to the issues raised by emerging technologies, business analytics and international exposure. The FTC began the information policy process in the United States over a decade ago. That effort has been an adjunct to its consumer protection mission, and while admirably carried out, not sufficient for tomorrow's challenges.

Development of solid information policy guidance requires a better-funded FTC with a defined mission to develop information policy guidance for the United States and to participate in international policy development related to privacy and security. It also requires research into new, creative mechanisms for enforcing privacy and security requirements in a rapidly evolving marketplace. It means staffing with technologists and other experts who will work with academia, industry and civil society to develop tomorrow's answers. The FTC must find ways to delegate and oversee mechanisms to resolve consumer disputes. Finally, this mission must include participation in international policy forums in a capacity co-equal to international data protection

authorities. Congress' role in this effort is to clearly charge the FTC with this mission and encourage its success through regular oversight.

Thank you again for the opportunity to testify. The Center looks forward to working with the Committee and the Commission to develop innovative, balanced solutions to information privacy and security issues that foster a vital, safe marketplace.

The Future of Business Analytics

Bruce McCabe

The rate at which digital information is being produced is increasing exponentially. At the same time, computer scientists are making it possible for machines to navigate new information landscapes, conduct deeper and more sophisticated analysis of what they find, and deliver the results in more usable and timely ways to managers. This paper looks at how business analytics will change over the next ten years, the impact of these changes on organisations, and how this will lead to new opportunities and challenges in the workplace.

Introduction

In recent years, business analytics has become a topic of particular interest for managers; the combination of new software capabilities and large amounts of usable data has been delivering consistently good results for organisations in every industry. A study of IT projects delivering greatest value in Australia identified business analytics as one of three dominant themes[1] and global companies such as Amazon, Capital One, Marriot International, UPS and Proctor & Gamble have secured substantial competitive advantages through superior analysis of their data assets.[2] Analytics solutions (there is usually more than one) can be found in every corporation and every major government agency, and IT managers are discovering, to their surprise, that the investment needed is often relatively modest compared to the value returned. Common applications of analytics in organisations are listed in Table 1.

This paper sets out to examine the future and answer the question: *How will emerging technologies shape the way analytics are used in business over the next ten years?* It is written for business people. The main focus, therefore, is on business outcomes, not IT projects; all managers can use it as they plan for emerging opportunities, challenges and changes through to 2017.

Sponsorship

The publication of this paper was kindly sponsored by Business Objects Australia Pty Ltd, a supplier of business analytics solutions. More information can be found at www.australia.businessobjects.com.

[1] McCabe, B, 2003, *High Value Projects in Australian Enterprises*, S2 Intelligence.

[2] See Davenport, H, 2006, 'Competing on analytics', *Harvard Business Review*, vol. 84, no. 1, pp. 98-107.

Using this document

The discussion in this paper is presented in two parts. Part I (pages 3-7) describes the key technology trends shaping the future of analytics. Part II (pages 8-16) describes how analytics will shape the future of business.

Predictions are made throughout this paper. Predictions are valuable for planners because they force the researcher to distil complex ideas into best guesses, based on what is known now, and give the lay person a single crystallised picture of a likely future. They offer a point that can be communicated and debated, and which can trigger new ideas.

To get the most out of this document, managers are encouraged to discuss these predictions with colleagues in the context of the products, services, markets, competitors and goals applicable to their own organisation.

While the predictions are written as if factual statements about the future, they are, of course, nothing of the sort. Many assumptions—about the pace of technology development, commercial value, social acceptance and rate of deployment—lie behind each. The only prediction that can be made with absolute certainty is that real outcomes will vary in scale, detail and timing—especially timing.

Managers are encouraged, therefore, to also read through the underlying technology trends described in Part I. By being conscious of these trends, they can equip themselves to adjust their plans when they encounter new technologies and hear about new breakthroughs.

Terminology

The most useful way to discuss the future is to set boundaries broadly enough to capture everything that matters. For the purposes of this document, therefore, S2 Intelligence defines *business analytics* as computer

analysis of information to assist managers with business decisions.

This definition includes data warehousing, data mining, business intelligence, enterprise performance management, date visualisation, executive dashboards, supply-chain analytics and many other themes current in business today. It is also broad enough to include future, yet to be seen analytics methods and applications.

When the word *routine* is used in predictive statements (e.g. 'managers will routinely track online sentiment ratings') it refers to when a technology or practice has been adopted by a wide range of organisations (i.e. not just leaders and early adopters) for everyday use.

A *knowledge worker* is a person that works primarily with information (as opposed to applying physical or manual skills) in their day to day activities.

When referring to the size of organisations, the following Australian Bureau of Statistics derived conventions are used: *small* enterprises employ 1-19 people; *medium* enterprises employ 20-200 people; *large* enterprises employ 200 or more people.

Methods

The primary source of data for this report was the repository of approximately 700 face-to-face and telephone interviews conducted by S2 Intelligence with computer scientists, IT practitioners, researchers, business executives, policy-makers and technology leaders since 2005.

Secondary sources include academic journals, conference proceedings, websites relating to emerging analytics products and services, and previous S2 Intelligence research where business analytics has emerged as a theme. These are referenced in the text.

On completion, a draft copy of this paper was sent to 18 computer scientists, researchers and product managers with expertise in various aspects of business analytics. Feedback received from them was incorporated into the final version before publication.

Feedback

S2 Intelligence continuously revises and updates its forecasts: all comments, ideas and alternative viewpoints on this document are warmly welcomed and can be sent to info@s2intelligence.com.au.

Sales trends and forecasts	Production scheduling
Cross-sell/up-sell recommendation	Inventory optimisation
Marketing campaign effectiveness	Supply chain bottlenecks
Product mix in stores	Product quality analysis
Retail layout, shelf allocation	Predictive machine maintenance
Contextual placement of advertising	Manufacturing process costing
Website structuring and linking	Asset deployment / utilisation
Shopping patterns, purchasing triggers	Human resource benchmarking
Capacity utilisation in airlines, hotels	Salary / productivity benchmarking
Service priority in call centres	Warranty trends
Call centre efficiency	Network security/threat detection
Frequently asked questions generation	Assessing operational risk
Expense budgeting	Fraud detection
Procurement optimisation	Money laundering detection
Distribution channel selection	Credit risk for loan approvals
Logistics modelling	Loss risk in insurance
Scheduling and routing of vehicles	Likelihood of future illness

Table 1: Common applications of business analytics

PART I: TECHNOLOGY TRENDS

The key technology trends shaping the future of business analytics relate to the information that can be analysed, the sophistication of analysis that can be performed, and improvements in how results can be delivered. These may be thought of as analogous to the same three themes that define the capabilities of all computer applications—input, processing and output.

1. Processing and storage hardware

The cost of processing power and computer storage will continue to fall steadily. This is a fundamental trend that underpins advances in all types of computer applications. It will be driven in part through continuing advances in design sophistication and manufacturing processes. It will also be driven by increasingly efficient use of hardware as organisations move to server and storage farms and apply new techniques to allocate workload more evenly across these assets.

2. Information volume

The volume of digital information being produced will continue to grow at an extremely rapid rate. No-one can quantify this exactly, but we can get some sense of scale from a 2003 study that estimated the amount of new information being created every year, and stored on print, film, magnetic, and optical storage media, to be 5 exabytes per annum—an amount equal to the information contained in 37,000 libraries the size of the US Library of Congress. [3] The majority of this is stored on hard disk drives, and annual production is estimated to be growing by 30 percent year-on-year. These calculations, it should be noted, apply only to new information—they exclude duplication of existing information.

Wherever new pools of business information are created in digital form, new analytics opportunities will follow closely. An example of this has been in the creation of purchasing data. Early adopters of electronic requisitioning and procurement systems reported their biggest financial benefit came not from efficient use of supplier discounts or fewer purchasing errors, but from analysing the new data they had on their purchasing.[4] Other new pools of data include audio, video and spatial data, described in the pages below.

Not all digital information, however, is analysable by computers. We can think of this in terms of the illustration in Figure 1. The outer cloud represents the total pool of digital information—growing fast but much of it off limits to computer-based analysis. The inner cloud represents the pool of analysable information, which is expanding as (a) software gets better at dealing with unstructured data, and (b) machine-friendly structure is added to some types of information.

3. Unstructured information

Most new digital information exists in the form of text, images, audio and video that has little structure or organisation. While it is relatively easy for humans to analyse small portions of it (by browsing the web, reading through documents and making notes, for example), computers run into difficulties because they are best at processing information that is highly structured (organised, for example, using standardised formats, fields, records, labels and hierarchies).

An especially important trend, therefore, will be steady improvement in the ability for computers to navigate and process unstructured information through natural language processing, search, inference and categorisation. [5]

4. Structured information

Separately, more structure is being added to various information landscapes through wider application of machine-readable labels, tags and rules (metadata) that act as signposts for computers, enabling them to contextualise the information that they find.

Adding structure data in this way is powerful, but it also requires agreement on labels, tags and rules by all interested parties. Consequently, industry wide standards initiatives—which must factor for competing needs across thousands of organisations—will remain slow. Faster progress will be concentrated where there is especially strong value in undertaking this work, and where a few dominant players can force

[3] See *How much information? 2003* at http://www2.sims.berkeley.edu/research/projects/how-much-info-2003/

[4] McCabe, B, 2003, *Supplier Relationship Management in Australia and New Zealand*, S2 Intelligence.

[5] GeneWays is an example of natural language processing applied to analyse unstructured research articles (in this case to identify molecular pathways for healthcare, bioinformatics, and pharmaceuticals purposes). See http://geneways.genomecenter .columbia.edu/

the pace. Where industry wide initiatives gain traction (the strongest candidates are health and life sciences) they will significantly boost the possibilities for computer-based analysis. [6]

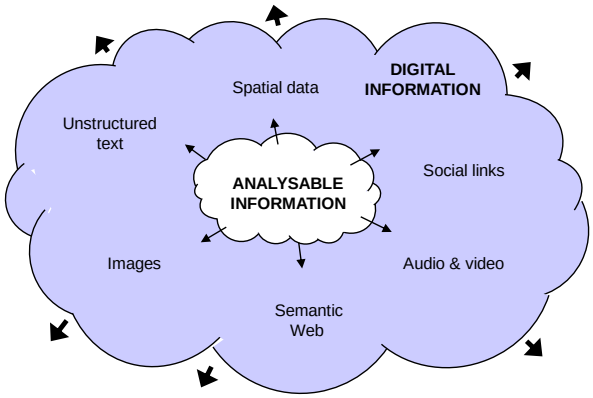

Figure 1: Pool of analysable information

5. Location

Location-based (spatial) digital information will increase exponentially. Much of this will be accompanied by time-based information. A key driver is the proliferation of spatially aware radio devices—mobile telephones, WiFi, GPS, radio-frequency identification (RFID) tags, wireless sensor networks—as the costs of these technologies fall. Other drivers include the dramatically improved usability of online location-based services (especially via spatial browsers such as Google Earth/ Maps). These enable businesses to 'mash-up' information, services and maps and publish these to any employee or customer that has access to a browser, for almost no cost. As location-aware devices and services proliferate, so too will the amount of useful data stored within organisations, most of it in a structured form that lends itself well to analytics.

6. Images, audio and video

The ability to interpret the contents of digital images will improve steadily. Analytics software will move beyond mining textual metadata associated with images (i.e. the descriptions and tags stored with them) to analysing the content of many images on the fly. [7] [8]

Continuous media, in the form of audio and video files, are extremely rich in information. At the same time, however, they are notoriously difficult for computers to navigate and interpret. Business analysis is typically limited to what human operators can watch/listen to and write up in reports. For most businesses this means audio and video is excluded from computer-based analysis.

Steady progress is being made in technologies to navigate and analyse continuous media files. The quantity and value of this information, especially collected via the call centre, and posted on the web, provides a strong imperative to apply it in business.

Developments in the application of natural language technologies to transcribe the speech found within continuous media files are especially important. When soundtracks are converted to text they can be much more easily searched and analysed. A ready benchmark for progress here is the quality of current online services for searching video.[9]

Structure is also being added to continuous media files. Researchers have developed new languages for describing and time-stamping events within clips, and new containers for keeping descriptions with the audio or video component.[10] As these mature, continuous media files will be transported across the web with fully transcribed, time-sequenced audio tracks, and will become as easy to analyse as ordinary text.

7. Social links

Social networks are important targets for analysis. Identifying relationships between people, their interests, and other people is extremely valuable in business, and the proliferation of websites offering services built around sharing, collaboration and networking, a phenomenon sometimes labelled 'Web 2.0' is driving an exponential increase in information relating to connections between people.

This type of information is already associated with structures that can help computer navigation, including email directories, links through citations, dates on blog entries, and common membership of online communities[11] and business workgroups.

[6] The Semantic Web is an important set of initiatives aimed at applying more structure to the web to make it easier for computers to navigate. See http://www.w3.org/2001/sw/ for information on current activities.

[7] See Polar Rose, www.polarrose.com, for an application of analytics to online images today.

[8] A recent paper about the cutting edge of image search and retrieval is Carneiro, G, Chan, AB, et al, 2007, Supervised Learning of Semantic Classes for Image Annotation and Retrieval, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol 29, No 3, pp 394-410.

[9] See, for example, www.blinkx.tv

[10] An important example is www.annodex.org

[11] e.g. LinkedIn and MySpace at www.linkedin.com and www.myspace.com

Semantic web initiatives will play a role in providing structure as well.[12]

Computer scientists are making rapid progress in analysing this type of data for business purposes. An example is conflict of interest detection, where experimental systems are detecting potential conflicts by analysing multiple online social networks together.[13]

8. Search

The link between developments in search technologies and developments in business analytics will get stronger. Computers must be able to find data before they can analyse it. Each step forward in refining the outputs of search engines also represents an improvement in the data that can be sourced for analytics engines. Specialist audio mining tools already allow, for example, keyword searches of news clips, earnings announcements and recorded briefings. This also applies to search within organisations: enterprise search is rapidly improving in scale and sophistication and soon every knowledge worker will have the contents of their PC indexed by a desktop search engine. The parallels with search extend to interfaces, with analytics software progressively adopting the flexibility and familiarity of search interfaces to improve accessibility by non-specialist employees.

9. Broader, deeper insights

Computer scientists are pushing ahead in a range of fields—machine learning, data modelling, simulation, categorisation, abstraction, inference engines, heuristics and constraint programming—that will make computer analysis deeper, more accurate, and more useful.

Analytics systems will be able to consider more variables when producing recommendations. Advances in constraint programming will see business computer systems consider more variables when producing recommendations. The quality of analysis of the complex, multivariate problems common in logistics, scheduling, and rostering will improve steadily.

The emphasis in analytics systems will steadily shift from measuring to modelling business trends and processes. Machine learning methods will help computers generate their own data models, instead of being constrained to human-generated models when trying to identify correlations and relationships.[14] Analytics systems will progressively incorporate the ability to identify gaps in their own knowledge.

10. Presentation and usability

In business situations, timely approximations can be invaluable, while analysis that arrives after a decision has been made is worthless. As the scale and complexity of information fed into business analytics increases, so too will the importance of abstraction, summarisation, delivery and presentation. The most valuable systems will be those that distil data from many sources into simple pictures that managers can digest and act on quickly. Technology developments will produce systems that become progressively better at:

- Producing simpler and more visual data views and reports.
- Allowing data views and reports to be generated by non-specialist employees.
- Abstraction and summarisation, to give managers more concise output and more specific recommendations.
- Learning from previous requests so that information is displayed in the order and priority that individual users prefer.
- Assessing timing, so that software fades into the background during 'business as usual' periods but actively pushes information to users when it is of high relevance or urgency.
- Tailoring output to suit the device (e.g. phone, PDA, laptop, web browser) and context (static, mobile, making a tactical decision or preparing a strategic plan).
- Being easily accessible from familiar and everyday applications such as Microsoft Office.

11. Software as a service

An increasing proportion of all business software will be provided to customers in the form of a service that is accessed over the web, as opposed to a product installed in the customer's business. This is a gradual, but fundamental IT trend. The important technical drivers are improvements in software architecture, integration technologies (see Section 12) and network infrastructure.

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[12] See, for example, The Friend-of-a-Friend (FOAF) Project, www.foaf-project.org

[13] See, for example: Alaman-Meza, B, Nagarajan, M, et al, 2006, 'Semantic Analytics on Social Networks: Experiences in Addressing the Problem of Conflict of Interest Detection', *Proceedings of the 15th international conference on the World Wide Web*. pp 407-416, Edinburgh.

[14] The STaRControl project exemplifies advanced modelling and machine learning in the context of traffic analysis. See http://nicta.com.au/director/research/projects/s_to_z/star/starcontrol.cfm

Economic drivers are equally important. Decision makers are attracted to the notion of no upfront investment, predictable annual costs, and leaving the management of software, including upgrades and patches, to providers. Pricing and service models will mature rapidly through the next five years.

12. Web services

Global take-up of web services—ubiquitous web based standards for software integration—will make connecting software applications within and between organisations dramatically more cost effective. As the cost of integration falls, and major software suppliers gradually move to supply their products in more modularised form, it will become easier to connect analytics engines with financials, office productivity software, specialised purchasing software, planning and collaborative tools, CRM packages other analytics systems and any number of applications and information services available on the web.

This trends applies to individuals as well as organisations: it will become steadily easier for any individual to put together and publish their own integrated combinations of web applications, as we are seeing with mash-ups of mapping services today.

13. Privacy preserving technologies

The maturation of technologies that allow rapid analysis of distributed data will make it much easier for organisations to analyse shared information. Shared analysis will get easier for individuals, collaborating workers, and public communities of interest.[15]

An especially important driver will be privacy preserving technologies that automatically strip identifying data from customer records. These are already being applied in the healthcare domain to help researchers locate, aggregate and simultaneously analyse patient data residing in many different hospitals, institutions and laboratories.[16] Advances in software integration (Section 12) will also be important.

There is a strong imperative to do this better: shared analysis is important between trading partners that collaborate closely (between big retail chains, for example, and their suppliers of fast moving consumer goods), but is slowed by negotiations and manual data preparation and cleaning procedures.

[15] Swivel and Many Eyes are examples of open websites for shared exploration and analysis of data. See www.swivel.com and http://services.alphaworks.ibm.com/manyeyes/home

[16] See the Health Data Integration project at http://e-hrc.net/hdi/ and the CSIRO's Privacy Preserving Analytics at http://www.csiro.au/science/ps59.html

14. Human inputs

Analytics systems will incorporate more inputs directly from humans. When workers combine on-the-spot observations with what they know about the global picture their personal analysis is very valuable. Steady improvements in interfaces, machine learning and inference-making will see more of this captured by systems to refine reports, forecasts and recommendations. Community effects, as pioneered in blogs, wikis and other collaborative models on the web, will also be harnessed this way.

Sophisticated combinations of human and machine analysis are already found in hybrid share trading systems that combine algorithmic trading with decisions made by human brokers in the securities industry. Specialist solutions are also emerging to analyse combinations of objective and subjective data for human resource management.[17]

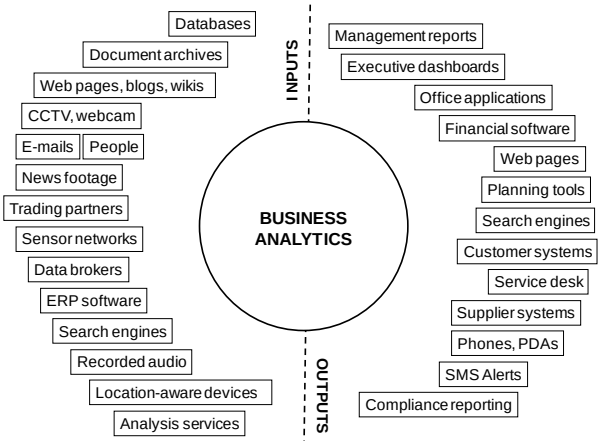

Figure 2: Business analytics ecosystem

15. Affordability

Research and development of new analytics technologies will continue to be driven in sectors where there is highest value. As with most information technologies, broader adoption will follow as technologies mature, fall in price, and become available from more providers.

The very large relative research and development investments mean that defense and healthcare in particular will continue to provide leading indicators for technologies that will eventually find their way into all businesses.

[17] An example of this combination is found in the Mentor system (www.corporateknowhow.com)

New technologies will generally follow a top-down progression from initial adoption by corporations to adoption by medium and then finally small businesses. Some will become consumer technologies. A similar progression will apply within organisations as it becomes cost effective to deploy analytics to more departments, employees and devices.

16. An expanding ecosystem

Based on many of these trends, we can picture analytics systems as ecosystems, as illustrated in Figure 2, that are accepting inputs from an ever wider range of sources, and producing outputs for an ever wider range of destinations.

PART II: BUSINESS IMPACTS

This section describes how analytics will shape the future of business. The discussion moves back and forth between three levels: *industry*—changes to interactions between organisations; *organisation*—how organisational capabilities, routines and norms will change; and *individual*—changes that individual workers will experience.

17. Embarrassment of riches

Through 2017 the data coming online and made available for businesses will outstrip the capacity to analyse it.

All organisations will continue to balance infrastructure investments against the analytics capabilities they would like to build. Falling costs in storage, servers and network bandwidth will be insufficient to keep up with demand to perform complex analysis more often, on more data, by more employees. Companies will constantly be surprised by the sheer volume of data they are generating and collecting.

By 2010, the notion of the information lifecycle, with limits placed on how long some types of information should be retained, will become very important.

Today, on average, companies only utilise 42 percent of internal data that relates to their customers.[18] In 2010, because the data pool is so much larger, they will struggle to improve on this figure.

By 2011, almost all large organisations will have dispensed with "keep everything" strategies for business data. Managers will routinely consider one of their major IT challenges to be choosing what data to throw away, lest they use up storage capacity too rapidly.

More and more companies will turn to service providers (see Section 18) so they can access storage and processing power on an on-demand basis.

Through 2013, at least one in two organisations that invest in business analytics as a key corporate strategy will experience problems with projects that attempt too much too fast.

By 2014, industry leaders will be defined as much by the data they choose not to use as by the data that they use.

In 2017, even leading proponents of business analytics will rarely exploit more than 10 percent of the quality business data that is both available and relevant to their context.

18. The analytics economy

We will see rapid shifts as businesses capitalise on opportunities to provide data services, and perform data analysis, on behalf of other companies. Many of these 'analytics service providers' will aggregate data and translate it between formats as part of the value they deliver.

The most successful analytics service providers will offer access to deep expertise, specialist skills and experience. Their value proposition will be further enhanced by superior IT infrastructure and the processing power they can bring to bear on a problem, and they will invest in (or partner with providers of) large-scale server and storage facilities.

Through 2009, most online analytics services will be aimed at people who will manually navigate to them and access their analysis using browsers.

By 2011, significant online data brokers will be found in every industry sector. Many will have a background in market research, consulting or finance where they built up rich repositories of specialist data. Online retailers will also be pioneers in online analytics services.

By 2012, most specialist research companies (e.g. automotive, demographic, building, real-estate research firms) will be online analytics service providers.

By 2013, almost all analytics services with business value will be computer accessible, where customers can connect their software directly to the service over the web. Very sophisticated services will have emerged. All competitive market research, news, media and advertising businesses will be analytics service providers. Leading finance companies will have adapted in-house market analysis systems to make them available externally as online services to customers. Much of the value provided by advertising companies will be in pre and post advertising analysis.

By 2015 there will be a substantial global economy built up around merchants that buy, sell and rent out their accumulated data on the web.

At this time, dominant trading partners in every industry will make healthy profits from providing analytics services for other organisations. Specialist insurers will sell data and risk analysis services to companies in other sectors. Transportation companies

[18] CIO Insight, *The 30 most important IT trends for 2007*, November 17 2006, www.cioinsight.com

will sell data and analysis to other companies for logistics planning purposes.

By 2016, organisations will routinely blend collections of internal analytics engines and hosted analytics services in such a way that the sources are indistinguishable to users.

19. Collective insights

Organisations that work closely together in partnerships and alliances will steadily find themselves pooling more of their data for combined analysis. These networks will be underpinned by commercial arrangements that specify rental fees and reciprocal rights. These will lead to additional revenues for data-rich companies and new costs for data poor companies.

Through 2011, data sharing arrangements will expand between large retail chains and manufacturers with strong consumer brands. Early adopters of multi-organisational analytics will also be found in the insurance industry (e.g. sharing across insurance alliances), finance (e.g. sharing between finance companies and mortgage brokers), and business services (e.g. sharing between providers of complementary services).

By 2013, conducting cross-organisational data analysis will be as routine as conducting cross department data analytics is today.

By 2014, data sharing networks will exist that span industries, and facilitate aggregated analysis of information owned by hundreds of organisations at a time. Manufacturers will analyse data owned by retailers, airlines will access datasets distributed across many travel agents, and automotive manufacturers will access datasets distributed across car dealerships. Allied groups of insurance brokers will generate significant new business through the combined analysis of their social networks.

By 2016, data sharing will be taking unusual forms and coming from unexpected places. Taxi companies, toll operators and courier companies, for example, may pool analysis of vehicle movements to gain deeper insights.

By 2017, industry networks will exist that routinely analyse data stored in more than a thousand small businesses.

20. From microscopes to telescopes

Although the customer data owned by an organisation will remain one of its most valuable assets, the vast amounts of external information available, and increased capacity for systems to analyse it, means that the external data pool will quickly outstrip the internal one in scale. All businesses will end up analysing significantly more data residing outside their organisations.

By 2011, managers in leading organisations will understand that competitive business insights depend more on how they interact with an ecosystem of external service providers than on how they process internal data.

By 2013, managers in large enterprises will routinely receive computer generated recommendations based on a thousand times more external than internal data.

By 2017, managers in large enterprises will routinely receive computer generated analysis and recommendations based on a million times more external than internal data.

At this time, companies in the travel industry will monitor cost trends for all destinations they service by crawling massive numbers of web-based data points on room prices, vacancy rates, retail prices and bus and train fares.

21. David becomes goliath

Medium and small businesses will rarely own as much information as large corporations. Nor will they be interested in the same types of analysis because there is less scope for optimisation in less complex organisations.

Many kinds of analysis will be valuable, however, regardless of business size, including customer profiling, sentiment analysis and market trends analysis. Smaller businesses will also have access to the same data ecosystems, and the same tools as these become accessible as services over the web.

New opportunities for small businesses will also come from ‘scaling down’ the cost and complexity of systems that are only practical for large organisations today.

By 2010, managers in one in five mid-sized companies will access computer analysis of customer and sales data on a daily basis.

By 2013, managers in mid-sized companies will routinely access computer analysis of sales, production, and supply-side information on a daily basis.

At this time, managers in a third of small businesses will routinely access at least one online analytics service on a weekly basis.

By 2014, small business managers will routinely reference benchmarks developed by pooling data from hundreds of their peers. These benchmarks will typically be accessed from within their regular accounting software.

22. Location-aware enterprise

The explosion in location-aware chips, tags and devices will see organisations gain entirely new insights on their assets, staff, customers and products.

By 2010, analysis of real time spatial data for mobile and in-the-field assets such as vehicles and heavy equipment will be routine in transportation, logistics, mining and agriculture.

By 2013, medium and large manufacturers will routinely analyse data on the location, distribution and utilisation of containers, palettes and roll cages.

By 2015, organisations in supply chains for big retail chains will routinely analyse the movements of hundreds of thousands of fast moving consumer goods.

By 2017, asset managers in large finance and business services companies will routinely analyse, from a single console, the distribution and movement of all corporate assets worth more than ten dollars.

23. Walls have ears

Audio and video will quickly grow in importance. Sources will come from within the organisation as well as from outside. An especially widely used source will be audio data from the call centre.

Images will begin to constitute an important source of business data, especially where they are associated with identifying events or changing conditions in a building or commercial environment, or with identifying people and places.

By 2009, insurance companies will routinely use systems that analyse speech for stress and produce real-time risk indicators during calls into claims processing centres. These systems will substantially reduce fraud rates.

By 2011, personal voice risk analysis will be routinely used by sales representatives in all industries to help verify customer buying intentions over the phone. Many of them will do this without the knowledge of clients or their managers.[19]

By 2014, more than half of large businesses will routinely analyse recorded audio in call centres to zero in on anomalies, problem products and customer gripes.

By 2015, the automated analysis of foot traffic via CCTV, once only available to managers in casinos and supermarket chains, will be available as a cheap webcam plug-in and routinely used by small retailers routinely to optimise window and shelf displays.

By 2016, audio data mining will be used by one in two large organisations to tune the methods of tele-sales and over-the-counter sales people.

By 2016, large organisations will routinely use software that recognises voice patterns to produce rich insights on when and how customers contact them.

24. Sentiment tracking

Business analytics systems will be able to take advantage of new algorithms to draw inferences from material in discussion forums, customer feedback, e-commerce and auction sites, news clips and analyst reports to infer overall positive or negative sentiment about companies and products.

As sentiment analysis develops and becomes more realistic, it will turn into a key metric that is monitored daily in all businesses and industries. Investors and consumers will change their behaviours based on the sentiment analysis available to them.

By 2010, online sentiment analysis will be routinely offered as a service by market research and advertising companies.

By 2012, sentiment analysis will be routinely used by companies to analyse customer feedback and recorded audio from the call centre, to improve customer service outcomes.

By 2013, managers working in companies with high profile consumer brands will routinely perform sentiment analysis of audio, video and textual news feeds. During periods of adverse publicity (e.g. product recalls) they will benchmark impact against preceding months, and monitor progress as public relations campaigns try to repair the damage.

By 2014, corporate sentiment analysis will incorporate continuous crawling of blogs, product rating websites, news services and social networking web sites for mentions of the company and its products, scoring relevant comments as they go. Managers will routinely monitor changes in goodwill and market sentiment on a weekly basis, not only for their company but also for their biggest competitors.

At this time, brokers will routinely use sentiment analysis in valuations and share trading. Sentiment analysis will be widely applied by individuals to score online feedback posted about hotels, restaurants, airlines and travel destinations.

By 2015, high profile professionals and executives will routinely monitor 'personal brand awareness' based on how frequently their name is mentioned and in what context.

By 2016, random online searches for information on products will be returned with customer satisfaction 'meter readings' for both the target item and nearest equivalent products from alternative suppliers.

[19] AVS is an example of a commercial voice risk analysis solution (www.digilog.com), and Kishkish is another, available as a downloadable plug-in for skype users (www.kishkish.com).

By 2017, executives and company spokespeople will routinely face shareholders that call up, with a few mouse clicks, an overall analysis of everything they have ever said publicly on a topic.

25. Reputation wars

The developments described above will lead companies to move beyond monitoring to using technology to actively manage and influence online sentiment.

By 2014, companies in the public relations industry will routinely offer automated services to help skew online sentiment results and boost online reputations.

By 2015, the 'reputation wars' between reviewer and reviewed will take on the resemblance of a subtle but ongoing arms race. Leading providers of sentiment analysis services will be continuously refining their methods for detecting manipulated data, and for assessing the trustworthiness and integrity of online sources. They will routinely exploit social networking data to detect relationships between the reviewer and the reviewed.

26. Knowing who you know

Managers will get very powerful outcomes from social network analysis. Early applications will continue to have an inward facing flavour, but sophisticated online tools will also open up a world of new insights. This will produce new social challenges.

By 2009, large organisations will routinely analyse the structured information in e-mail and internal directories to help find people with specialised knowledge, or social connections relevant to a task.

By 2010, a variety of services will be available online that automatically produce social network analyses on any person for anyone that wants it—for free.

By 2011, entrepreneurs will routinely use web profiling to find social connections to secure deals. Sales reps will automatically profile prospects before calling. Managers and employment companies will profile job candidates as a matter of course.

At this time, managers in companies of all sizes will routinely use online tools to mine people and associations from news stories, blogs and company websites.

By 2012, online conflict of interest detection will be undertaken routinely and automatically during legal disputes, company acquisitions, hiring and selecting contractors.

By 2013, online social network analysis will routinely incorporate information on the identity of people that appear in digital photographs.

At this time, job candidates will often find themselves confronted with interview questions about associations with 'undesirable' people or organisations, even if these associations were made accidentally.

By 2017, large companies will routinely mine digital recordings of internal seminars, training sessions and planning meetings to improve the mapping of social networks and knowledge associations between employees.

The analysis of social network and unstructured data within organisations will produce new workplace challenges. Many organisations will experience disruption as employees object to having their email archives mined for associations. Other challenges will come from increased scrutiny of personal activities and connections. Companies that execute well will be careful to preserve privacy and give individuals strong personal control over information sources that are analysed.

27. ROI-per-customer

The notion of being able to quantify the value of individual customers, something that already exists in many organisations, will become much more comprehensive. Analytics systems will produce insights on cost, risk and profitability for individual customers, taking into account such things as call volumes, preferred communication channels, product mix, location and sentiment analysis.

By 2011, dashboards used by customer service and sales personnel in banks will routinely emphasise predicted customer value over current/historical value.

By 2013, large organisations will routinely use data from their customer base to model projected take-up, rate of return and profitability for new products and services.

By 2017, businesses will routinely use projected ROI per customer as inputs to their long term planning.

These developments will create new social challenges as ROI-per-customer metrics change the behaviour of service and contact centre personnel. Many organisations will experience customer backlash and adverse publicity as the service levels begin to mirror customer scores. Advanced organisations will quickly learn to accompany deployments with new procedures and significant training and education programs.

28. Bottom-up optimisation

Local analytics systems will connect and collaborate with one another across complex supply chains and business networks. Such arrangements will allow managers to make decisions based not only on rich local information, but also armed with insights about the impact of their decisions on other links in the chain. By empowering local decision-makers this way, connected analytics systems will help optimise trading systems from the 'bottom up'.

By 2012, supply networks in transportation, fresh food distribution, and fast moving consumer goods will routinely employ distributed analytics systems that interact and exchange information with one another. Businesses in these networks will significantly improve profit outcomes during adverse events and changeable conditions.

By 2016, distributed analytics systems will be deployed in all types of collaborative trading networks (including in services sectors) that are complex or changeable and cannot be modelled from the top down.

29. People meters

While human resources (HR) management will remain a domain dominated by subjective assessments of factors such as morale, job congruence, performance, skill levels, leadership and peer collaboration, computer analysis will play a growing role.

By 2009, managers in large organisations will routinely reference computer analysis when reviewing sales performance, salaries and expenses.

By 2012, comprehensive HR analytics solutions will be routinely deployed by management consulting companies as part of their organisational change methodologies.

By 2013, managers in large enterprises will routinely use dashboards that combine quantitative and qualitative human resource metrics for individual departments and projects. These will provide actionable insights on where to invest in training, where reporting structures are inefficient, and where changes to work allocation and staff roles need to be made to address bottlenecks.

By 2016, as HR benchmarking becomes more sophisticated, and bigger datasets are collected, large enterprises will build whole-of-company models to analyse human resources allocation and performance, and senior managers will routinely access cost versus return estimates for individual employees.

In organisations where these tools are applied well, employees will find themselves in a more attractive workplace where managers are armed with new and creative ideas, where there is a feeling of constant refinement of management practices, and where individual strengths are better recognised and utilised.

Considerable learning will be required, however, and many organisations will apply these metrics poorly. In these workplaces, employees will find themselves stifled by managers that frequently defer to standardised benchmarks at the expense of a deeper understanding of individual strengths and motivations.

30. 360° performance reviews

Performance reviews will progressively become more realistic. The notion of scoring performance and paying bonuses based solely on targets set at the beginning of the year will disappear. This will impact the way performance is measured for all managers and employees, but through the next ten years the main focus will be on sales representatives and senior executives.

As these practices become more common they will transform expectations. Top performing executives and sales people, for example, will only want to work for organisations where performance is analysed realistically.

By 2015, sales representatives will be routinely compensated for performance against a basket of metrics that include the performance of peers, competitors, and the market as a whole.

By 2018, customer service personnel will be routinely compensated for performance against a basket of metrics including indices of customer satisfaction before and after calls, overall satisfaction across the client base, and an online sentiment index.

31. Latency and velocity

Analysis will become more tightly linked to information sources over time, with fewer instances of people having to manually write-up, summarise or re-enter information.

The automation of information collection will be one factor. Examples include palettes and containers broadcasting their location and status in warehouse, loading bays or trucks via RFID chips, and moisture, salinity and temperature data feeds from distributed sensor networks in agriculture. Additionally, as integration becomes easier and cheaper, we will see more connections between machines that supply information and machines that analyse information.

Managers will receive insights that are progressively more timely. By exploiting information much sooner after it is created, they will make earlier and more effective decisions. Delays in critical business information will, however, remain a fact of life.

Outside the organisation, shareholders and analysts will receive increasingly timely analysis and will also imbed this in their decision making. A side effect will be a further shift towards ‘day trading’ and some increased volatility in financial markets.

By 2009, executives in the mining sector will routinely access, on a daily basis, accurate analysis of the profitability of each mine site. This will be calculated from continuous monitoring of data on input costs, deployment of assets and personnel, excavation rates and processing yields.

By 2012, managers will routinely access analysis on the status of manufacturing, warehousing, transportation and direct sales operations that is accurate to within five minutes.

By 2013, more than 65 percent of Australian Stock Exchange trades will be executed by autonomous and semi-autonomous dealing systems.

By 2015, leading organisations will see more than half of the digital information created in an organisation imbedded in analysis used by senior managers within 48 hours of it being created.

In 2017, near real-time analytics will be widely available in specific operations, but no large organisation will have achieved a capability where senior managers can access up-to-the minute assessments of financial position for the business.

Much is made of the goal of the 'real time enterprise', so why won't it happen? Some of the inhibiting factors have been described below in Section 34. Additionally, it will be impossible to eliminate human delays—in updating information like progress reports, new hires, expense claims, etc—and also delays in receiving information from channel partners and contractors. More importantly, the imperative to have real time access to the 'big picture' is imaginary. Senior managers don't need (and won't pay for) systems that tell them the financial status of a business on an hourly basis: at that level of granularity they cannot distinguish between fluctuations and trends, and the organisation is incapable of reacting that quickly to decisions.

32. Bottlenecks within

As speed of information becomes an ever greater competitive necessity, analytics will increasingly be applied to the efficiency of information systems themselves.

By 2010, businesses will routinely benchmark the time it takes for sales and service staff to access key information (including analytics outputs) while in the field.

By 2011, large enterprises will routinely use computer analysis to isolate unnecessary/problematic traffic to improve email practices and reduce 'email overload' problems.

By 2014, top-100 companies will routinely imbed analytics in business process outsourcing arrangements. Software will continuously monitor request and response times. Partner managers will review service performance metrics on a daily basis. The same metrics will be mirrored to the customer relationship manager working for the outsourcer.

33. Goodbye to budgets

Organisations will move slowly towards budget-less management, where fixed annual budgets are abandoned and replaced by continuous analysis of spend versus return. This will progressively free personnel from onerous bottom-up budgeting, and will make organisations more adaptable and responsive to change.

By 2011, large companies will routinely analyse whole-of-enterprise procurement data to identify opportunities to consolidate purchases and get additional discounts 'on the fly'. These insights will be imbedded in requisitioning systems and accessed by purchasing officers when they place orders.

By 2014, at least a quarter of large businesses will routinely use budget-less management in selected projects.

By 2017, at least a quarter of large businesses will routinely use budget-less management in one or more business units. In advanced organisations, accounting departments will morph into support services, spending most of their time providing on-demand ROI projections to managers.

34. Cultures of confidence

Data quality, and ensuring managers can trust the outputs of analytics systems, will continue to be an important challenge.

A contributing factor will be the continuous addition of new sources of information (especially external sources where there will be duplication, and big variations in quality and consistency). Mergers and acquisitions will play a role as well.

At the same time, analytics systems will become better at calculating and communicating confidence levels and probabilities associated with their outputs. Greater transparency of confidence levels in computer analysis will build trust in them, which will in turn accelerate adoption.

By 2009, large services organisations will routinely offer company-wide training on best practices in information management.

By 2011, many businesses will have simple, organisation-wide, terms for describing quality and confidence levels associated with reports and forecasts.

By 2013, these will be routinely institutionalised in policies and decision processes. Certain product decisions will only be allowed, for example, if predictions reach a 'Level 1' (high) confidence level, while market communications will be adjusted mid-campaign on 'Level 3' recommendations if they are the best available.

By 2013, the proliferation of external analysis services being used by different departments will make selecting and quality controlling external data resources a key focus in large businesses.

By 2014, specialist knowledge workers will routinely look up the confidence and quality levels for their business reports with a few mouse clicks.

Managers in retailers, logistics centres and mine sites will routinely click through reports to see archived CCTV and web cam footage that provides a deeper understanding of the causes of changes or adverse events.

By 2016, senior executives will routinely view aggregated confidence levels for top-level financial analysis with a few mouse clicks.

In 2017, large companies will still be striving for, but never achieving, "one version of the truth" where everyone in the organisation references the same analytics derived from the same high-quality and universally consistent sources.

35. Silicon and cerebrum

Organisations will get steadily better at combining analysis made by people with analysis made by computers. Human inputs will become an important way to improve quality of analysis. Analysis and collaborative planning tools will merge. Differentiating between human and machine contributions will become impossible.

By 2011, knowledge workers will routinely share insights with one another by posting ad hoc analysis, data visualisations and comments on web pages. Popular, useful creations will then be adopted widely within organisations.

At this time, organisations will routinely link software to websites that exploit 'wisdom of crowds' principles via popular tagging or voting, or facilitate analysis mash-ups, to create new sources of business intelligence.

By 2013, when managers get together to make quarterly sales projections, they will not only take into consideration computer predictions, but their projections will also become inputs to the analytics system. Each will inform the other to improve accuracy over time.

By 2015, managers in leading organisations will routinely submit new monthly reports in forms designed to be read as easily by machines as by people.

By 2016, workers will routinely note any discrepancies between what computer analysis is telling them and what they are actually seeing. Their inputs, along with comments on likely causes, will be used to continually refine quality of analysis. A point of sale manager in a retail chain may note that sales of some items go up when it rains and others only when petrol prices are high; shortly afterwards, an administrator will be prompted to add 24-hour weather and fuel price data feeds into the system.

By 2017, top level managers will routinely use combined human and machine projections to model industry scenarios for long term strategic planning.

By 2018, one in five large enterprises will combine the management of human and computer knowledge in the organisation into one strategy.

36. Knowing what you don't know

Self-learning capabilities will be progressively incorporated into mainstream business systems, moving them beyond predictions based on static models.

By 2012, managers in telecommunications companies will routinely access systems that become better at predicting profitability for handset/plan combinations by self modelling handset cost, network cost, call volumes, call times, mix of local and long distance, use of non-voice services, credit risk, handset upgrades, and network upgrades.

By 2013, managers in transportation, logistics and distribution companies will routinely use systems that automatically accumulate knowledge about the effects of urgency, loading times, different types of goods, traffic congestion, vehicle reliability and weather.

By 2017, analytics systems will routinely send suggestions to the IT department for trials, experiments and new data sources that can fill knowledge gaps, produce deeper insights and generate better predictions.

37. Securing information experts

The new opportunities presented by business analytics will have an effect on roles and responsibilities at all levels in the organisation.

The role of the most senior IT executive will progressively see more emphasis on information over technology, making the title of "Chief Information Officer" a more accurate reflection of the role. We will see a trend towards multiple senior technology managers, each specialising in either strategic innovation, systems operations, and information management.

Although systems will become vastly more usable by non-specialist personnel, demand for specialist skills will still rise. Information and knowledge management experts will enjoy a higher status as the quality and relevance of computer analysis becomes more business critical. The responsibility for finding, evaluating, selecting and managing external data services will grow in importance, as will the need to

institutionalise procedures to continuously improve data quality.

At all levels we will see growing emphasis on analytical, mathematical and software skills associated with managing information. The average knowledge worker will not be asked to become a statistician, but experience relating to information management will become more valuable on any resume.

Like their counterparts in larger organisations, small business managers will also find that new skills are required to compete effectively. The ability to bring together diverse information sources quickly and effectively will become a more significant asset.

By 2011, most large companies will have established competency centres to help business units extract more value from analytics.

By 2013, the analytics capabilities of a large organisation will be limited more by its ability to find and keep suitable staff than by its ability to maintain quality data and software.

At this time, analytics experts will rank among the highest paid IT specialists employed by large organisations.

By 2014, competition for people will see senior analytics roles most often filled by crossing traditional boundaries. Services companies will hire logistic specialists from transport companies, retailers will employ spatial information experts from mining companies, and manufacturers will source social network analysts from media companies. Experts in defence intelligence and health analytics will find lucrative career paths in mainstream business.

By 2016, organisations will routinely employ experts in knowledge management, collaboration and human-computer interaction as they try to blend human and computer knowledge practices, achieve continuous quality improvements, and promote a culture of good information practices at all levels.

38. Insights at your fingertips

Analytics applications will become a factor in all aspects of business operations. At the same time, however, they will not be an intrusive or dominant part of working life. They will become progressively better blended into the everyday working environment and hidden behind the scenes.

Workers will use analytics more often in their personal decision-making, although they will not always be aware of it. Websites will provide richer analysis to support buying, financial planning and career decisions, and social analytics will help careers by connecting them to more people and communities with the same interests.

Life will be as complicated as ever: ten years from now, knowledge workers will still be complaining about 'information overload' and will rate the inability to manage information as one of their most significant challenges.

Some organisations will fail to appreciate the importance of blending analytics into the background. A common mistake will be promoting 'metatag cultures' by encouraging employees to add descriptive tags to everything they produce—documents, spreadsheets, web pages, bookmarks, images and emails. This onerous approach will produce poor results. More advanced organisations will concentrate on using software to scan documents, monitor how they are used, and automatically append meaningful metadata.

By 2009, sales representatives will routinely call up customer analysis while working onsite.

By 2011, one in ten knowledge workers, in all businesses and industries, will access analytics software on a daily or weekly basis.

By 2013, sales representatives will routinely access customer analysis as they are driving to meetings, and more than two thirds of analytics queries in organisations will be made from within the familiar environments of the spreadsheet, browser or word processor.

By this time, instead of always working to make computer analysis more accessible, leading organisations will be spending equal time assessing where analytics are distracting or counterproductive.

By 2014, one in five knowledge workers will access analytics software on a daily or weekly basis.

By 2016, nineteen out of every twenty analytics queries will be made with free form text entered into interfaces that are as simple as Google's is today. Workers will retrieve even highly structured reports by entering a few keywords—enough for systems to suggest a likely match.

By 2017, senior executives will routinely access analysis that has been distilled into one line recommendations (e.g. "initiate a clearance sale to run down inventory on Product A") with the option to drill down to the metrics underneath.

39. Ministry of metrics

Developments in analytics technologies will impact governments as much as businesses. Dominant themes will remain improving service delivery (in all types of services, but healthcare will continue to merit special focus), making government operations more efficient, reducing welfare and tax fraud, and national security.

Information boundaries will gradually come down between departments and between levels of government. Whole of government analytics will eventually become routine. Despite public concerns,

citizen data will be routinely analysed across departments and this will produce new challenges.

By 2012, hospitals will routinely offer services that blend continuous home health monitoring with analysis capabilities hosted at the hospital.

By 2013, the government will be an important player in the provision of external analytics services for businesses. Agencies with trade, customs and industry development responsibilities will routinely offer hosted online services relating to markets, trends, opportunities, environmental monitoring, social and economic data.

At this time, most agencies will institute strong internal access policies for analytics systems because of new exposures relating to privacy and unauthorised/illegal use.

By 2014, computer analysis of e-health records will produce dramatic improvements in early diagnosis and early outbreak detection, and will be applied intensively to improve quality of care.

At this time, a variety of online services will continuously track public sentiment relating to policy and politicians. Changes to baseline metrics (e.g. after new policies are announced, interest rates rise, etc) will be monitored on a daily basis in government. These services will compliment, but not replace, formal polling of the electorate.

Purchasing officers will routinely access whole-of-government analytics to improve sourcing and procurement practices.

By 2016, workers in security agencies and police forces will routinely generate automated risk profiles for individual citizens based on data in the public domain.

By 2017, a national health network will exist that allows researchers to routinely analyse pooled health data sets spanning all public and private hospitals, all health research institutions and all government health departments.

40. Environmental analytics

An important new application for businesses will be environmental sustainability reporting, involving measurement and analysis of information relating to such things as energy utilisation, water usage and carbon emissions[20].

Governments will steadily raise the bar for detailed and timely reporting. Environmental analytics systems will be increasingly direct-connected to regulatory authorities and energy companies.

By 2010, agricultural businesses will routinely use computer analysis to optimise water use and distribution across land assets.

By 2012, analytics systems drawing upon distributed sensor networks will be adopted by a wide range of government agencies, councils, farmers and manufacturers.

By 2014, all types of organisations will routinely use combinations of analytics, sensors and smart meters to monitor and optimise energy use in office buildings.

By 2016, governments will consolidate and standardise the electronic sustainability reporting requirements for businesses across state, local and federal jurisdictions.

[20] An early example of a carbon tracking and reporting tool is CarbonView. See www.supply-chain.com.au

CONCLUSION

The value of analytics systems will continue to rise rapidly through the next decade. This will be driven by new data sources, continuing improvements in computer methods and the development of richer and more convenient ways of accessing the outputs.

For large businesses, the application of analytics to sales, finance, operations, purchasing, quality control and even human capital is already a universal competitive necessity. Within a few years, sophisticated analysis will be equally indispensable in medium sized companies, and before long to many small businesses. At the same time, business analytics will become an enterprise-wide phenomenon where all types of managers and knowledge workers benefit from richer methods of analysing digital information.

A strange and exciting new world awaits. By 2017, audio, video, image and spatial information will be incorporated in mainstream business analysis everywhere. Social network information will be aggressively mined for patterns and relationships, and the vast pool of commentary and news found on the web will be trawled daily by machines that benchmark sentiment and monitor reputations. Many companies will have taken steps towards eliminating annual budgeting altogether.

An analytics economy will spring up. Data rich organisations will enjoy lucrative revenues from renting out their information assets, and combined analysis of customer data will be routine between business partners in every sector. In complex supply chain networks, analytics solutions will communicate across company boundaries to help optimise the ebb and flow of products from the bottom up.

These shifts will mean that some aspects of IT management will be turned upside down. Managing information will itself become much more critical than managing the technology that processes it, and the volume of data sourced externally will dwarf the amount owned by the organisation. By 2017, it will become quite impossible, in many business situations, to distinguish between human and computer generated insights.

The future of business analytics will bring with it new human, social and cultural challenges. The detailed insights about us that can be gleaned from public data will often make us uncomfortable. Roles and workplace routines will everywhere need to adapt to accommodate and exploit new capabilities. For organisations, having the right skills will be most critical, and leading companies will always stand out more for the qualities of their people than the raw power of their information systems.

Analytics leaders will do a lot of learning. This learning will define competitive advantage because it will be context specific and impossible to buy. Late starters may be able to tap into vast quantities of external data, and will certainly access powerful solutions, but they will find no short cuts to building a culture that understands data quality, knows the limitations of machine analysis, and strives to continuously improve how the outputs are used to support everyday business decisions.

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About S2 Intelligence Pty Ltd

S2 Intelligence helps Australian organisations to innovate. It undertakes continuous research into emerging technologies and their application in businesses. Bruce McCabe has researched technology trends since 1995. More information can be found at www.s2intelligence.com.au or by contacting S2 at info@s2intelligence.com.au

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