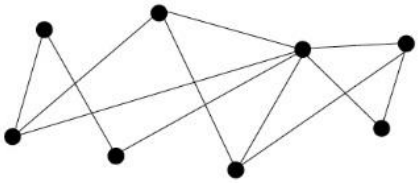
2015



Connect BI.

Whitepaper: building on business intelligence

THE DATA LED REVOLUTION AND ITS IMPACT ON BRITISH INDUSTRY

Forward

Business intelligence has long been in use across various industries and sectors but has only recently seen the importance of its role changed and heightened as we move towards a data driven economic model. With a shift towards industry 4.0, a gradual move to servitization, big data and the rise of the internet of things (IoT); BI has become the new key to competitive success.

The challenge for UK businesses today, lies in the adoption of these digital principles to implement BI effectively. It is imperative that BI is utilised within all organisations throughout the country. With large resources at their disposal, OEM firms have long been able to stay a few steps ahead of the game. Now lies the issue of pushing UK SMEs to take on these technological tools.

The success of data driven decision-making is already in evidence globally. The United States, Germany and other leading world economies have been implementing these models for years. Equally, China, South Korea, Brazil and other developing countries are slowly beginning to pick up this trend as the benefits of BI becoming increasing apparent.

It is imperative that all British firms stay competitive in a globalised, intertwined market. For this to be achieved, business intelligence and data analytics will have to become a business critical function for greater success.

Henry Anson

Managing Director

Hennik Research

Contents

Contributors

A special thank you to our contributors who are listed below.

Allan Behrens, *Managing Director*, Taxal Ltd

Allan is a well-known, quoted and respected visionary and acts as advisor to many in the IT and end-user community. He has participated in executive and non-executive roles as entrepreneur, director and mentor and works with numerous companies both large and small.

Syed Ahmed, *Director*, SAVORTEX

Syed is a Director at SAVORTEX Ltd, a founding committee member at The Manufacturer's Manufacturing Services Thought Leadership Network and a partner to the RBS Innovation Gateway. Syed was recently awarded Lloyds Banking Group, English Asian Entrepreneur of the Year 2015.

Robert Drake, *Principal Lecturer*, Sheffield Hallam University

Robert graduated as a Systems Engineer in 1985 before moving to the Syltone group as International Marketing Executive. During a decade in SE Asia he held several roles including; Country Manager (Indonesia and Malaysia).

taxal limited
business : technology : consulting

SAVORTEX®
A Smart Energy Saving Revolution

Sheffield Hallam University

THE Manufacturer

HENNIK

IoT, not just great technology

Content written by Allan Behrens

The questions I've been asked most recently on the topic of Internet of Things (IoT) relate to its value beneath (or beyond) the hype. Not surprising given the huge amounts of PR and tech talk attributed to the topic over the recent past. What's the proposition to (often smaller) business and consumers; as a business what can I do with it to attract (new) customers; how much can I make from it (additive, profitable revenues).

No simple answer I'm afraid. It obviously depends on what you do as to how you take advantage of the architecture. Naturally, any answer will based on circumstance – from a consumer of IoT (a user, perhaps a utility organisation, a manufacturer or a distributor, etc.) to a developer (software or hardware developers). Not forgetting, of course, technology integrators; the likes of systems integrators, cloud and managed service providers for example.

Reading last week's BBC article called "Is your connected car spying on you?" highlights common concerns that affect both consumer and developers; and that's to do with the topics of security and privacy. For those amongst us (consumers) that live in the cloud connected world, we worry about privacy and security, more now than ever before.

In my opinion, security and privacy aren't the same thing. The two may have connection and overlap but security in my eyes has to do with protection from nefarious misuse, whereas privacy has much to do with unintended, intended, misuse, use and distribution of privileged/confidential information.

The question for those looking at developing or using IoT is how safe are we and information we deem privileged, and how safe is the use of and the construct of the IoT. An interesting

topic and one I know software, hardware and service providers are grappling with. Cisco for one, has recently announced that it's investing a billion dollars in an IoT led network infrastructure that aims to deliver both security and privacy to the IoT world. A development that will be closely watched, if not mirrored by its competitors.

Coincidentally, and at a meeting last week, we discussed whether there was a place for the Internet of Things as well as an Intranet of Things. Well, the latter might make it more secure, but it still doesn't solve privacy issues, and its application defeats some of the value propositions of the Internet of Things. To this end Cisco's solution might just offer one solution to the dilemma -but it's aimed at the enterprise. What about the rest of us (read consumers)?

The IoT is more than hype. For my part it really can provide delivery and consumption of some very interesting and valuable products and services. But as with all technology, provisioning and use must be made with confidence. For example, I don't want anyone messing with my car's engine management system, but I do value the fact that my chosen agent knows that there's a service due and contacts me appropriately.

In the present and forthcoming rush towards broader IoT application, let's make sure that the values that the IoT brings isn't subsumed by the concerns the BBC article highlights. I'd suggest that its rapid adoption won't just be about great technology, it'll be about great technology delivered in a manner that delivers it as useful, practical, private and secure.

Product development practices and IoT

Content written by Allan Behrens

The Internet of Things (IoT) promises a step change in the added-value of tomorrow's products. Of course the intelligent connection of product and services offers significant value-add to companies and users, but it's not just the end-user that benefits. Manufacturers can enhance new products with features and services that deliver additional revenues and profit; potentially over lengthy timeframes.

At IBM's Innovate 2014 event in Orlando (a conference focused on users of the Rational Software Brand), IBM spent much time talking on its vision for product developers. They use the phrase 'Continuous Engineering' to label the ecosystem in which companies develop, deliver and operate products with high levels of complexity and 'interconnectedness'. To the topic of the IoT, IBM's thinking about "What it means to be the maker of 'things' in the Internet of Things" to quote Steve Shoaf Go-to-market manager for Systems Engineering for IBM.

Focusing on what customers want/need as opposed to what your products do is of course a worthy objective, but in this case it's one's that's raised some fundamental questions; the most significant being 'are current product development practices fit for purpose in the IoT world'.

The problem is that many of our products and the environments in which they're designed manufactured, exist and are serviced, have become complex. And the IoT has only accelerated and exacerbated these complexities.

Why do I say that? Well, for a number of reasons. Possibly most apparent is that the IoT changes the dimension of what was an arguably finite system into a morass of systems of systems. Take the satellite navigation system in a car as one example. Historically somewhat standalone and reliant on pre-loaded maps and GPS positioning satellites, perhaps in the more advanced cars, integrated with the radio/CD system. In todays' world, we have

numerous in-car situational, environmental and infotainment systems that need to act in party; media, mobile phones, vehicle information, car controls, environmental control; many of these communicating with over 100 ECUs that deal with the in-vehicle control systems and the like. In the IoT world the complexity goes one step further; our satellite navigation and interconnected system is now party to a host of other systems (of systems); local traffic and information services, road condition monitoring systems, dealer service centres, other vehicles in the proximity etc.

I, for one, subscribe to the vision of a more open interconnected, more cyclical and agile development environment. Change must of course be made with due diligence to compliance, however the intelligence, immediacy and flexibility that we need to develop product in the world of IoT means that people and information must work in concert, and with immediate access to information and requirements/parameters. With this in mind and given the disaggregated nature of many product design environments (mechanical, software, electronics, hydraulics etc.), the next generation of technologies must serve to counsel and direct developments, not overwhelm. I've long held that the lack of 'openness' of software products (and their data) is a limiting factor to making this an eminently practical proposition. Realistically, no single ISV can uniquely deliver all of our development needs, and customers want to spend time working on product, not on digital disconnects and the software industry needs to move on apace to allow this to happen.

An effective systems methodology will help to address some of the methodological developmental complexities, but to be practical this needs to be highly automated and augmented by technology. In current 'systems thinking', model based design and simulation tools fit well with this ideology; allowing users to model and integrate systems and designs early, simulate frequently and iterate often. They allow users to evaluate and optimise efficiently, and by using virtual as opposed to real tests means that they can have greater confidence of function and performance at an early stage in the lifecycle; reducing the need for expensive physical prototypes. Increasing confidence and the improving accuracy of these solutions is helping to make them a more practical proposition across a broad swathe of industries including automotive, aerospace, and medical and consumer devices. Many would

argue that democratisation of these tools is now not a matter or ‘if’ but ‘when’, and the promise of new entrants and more cost-effective, practical solutions will certainly encourage adoption outside of the larger enterprises to mid-size users; their needs being no less demanding.

Back to IBM. Their rapidly evolving development vision touches on areas of social integration, Cloud, ‘Big Data’ and analytics. IBM cites these add value to the intelligence of products and their services, and, of course, their respective development environments. Some may consider this as a step too far, but given the interconnected nature of the next generation of even more complex products, for example the autonomous car, I can see where they’re coming from. As is often said “change is the only constant in life”. Changes forced on us by the complexity of modern products will definitely require change in our development practices and methods, and software suppliers and their tools must adapt rapidly to allow manufacturers to garner profit from these changes.

Utilizing BI – waste, efficiency and resources

Content written by Syed Ahmed

Technology Strategy Board funded SAVORTEX, and creators and suppliers of the energy saving, smart hand dryer range, EcoCurve, reveals how its meeting the demand for capture of the rapidly increasing availability of information. Syed Ahemd, director at Savortex, has been looking into how data and information are becoming the core for a growing number of business.

The need to identify areas of waste and inefficiency in pinpoint detail to maximise resource efficiency and minimise costs has long been acknowledged. It is only in recent years that the technology has been available to do this and even more recently that it has been affordable. With technology costs lowering and energy costs rising the new challenge is to make that data available to all those who need it to make decisions - in a form and at a time, which empowers the decision makers in organisations.

At a recent Directors' Forum Dinner hosted by The Manufacturer, Syed Ahmed, director of SAVORTEX, commented on the rapidly increasing availability of information at all levels of business, challenging industry to evolve from a closed information culture to an open one. The CTO of Microsoft Services, Angus Foreman, explained how Microsoft is creating seamless access to data across multiple devices, from desktops and laptops to tablets and smart phones. Microsoft's goal is "to enable real-time collaboration and collective creation among many people across multiple locations".

At that same dinner representatives from BAE, MBDA and Tata Steel, all commented on the need for culture change within organisations in order to realise the benefits of the information potentially available.

With more data, greater opportunities are available for organisations that have an open, transparent decision making culture, while respecting the confidentiality of the information. It

is becoming increasingly clear that energy, waste and cost cannot be reduced unless pinpoint source data is collected and converted into actionable information. SAVORTEX is focused on developing innovations for a future founded on a low energy, sustainable and smart built environment.

SAVORTEX found that hidden risks in buildings i.e. energy and waste can be identified and turned into profitability through smart technology that produces actionable data. We have designed in the UK, manufactured and launched the most environmental and smart hand dryer every produced where the technology creates value on the client's site, serving directly into the product servitisation business model. The project was part funded by Innovate UK.

The smart dryers are connected to the internet recording - through sensors and M2M technology - real-time energy usage and washroom footfall, reporting the data to the web.

The data intelligence collected is allowing our clients like Carillion, RBS and Canary Wharf Group to centrally manage their washroom facilities from the cloud. The result is exactly what Microsoft CTO Angus referred to, "enabling real-time collaboration and collective creation among many people across multiple locations". The data provides profit-boosting insights through faster problem resolution and a significant reduction in cost, waste and energy, and improved resource efficiency.

We serve sustainability focused private and public sector organisations like the Royal Bank of Scotland (RBS), Carillion Plc., British Airways and Marriott Hotels to name a few, which are experiencing huge savings in cost, energy and waste by using our smart technology. RBS recently announced savings of £35,000 and 14 tonnes of waste per building per year by switching over to our smart dryers.

Apart from managing the washrooms, the data means different things to different building owners and that's the power of the internet of things. It provides a holistic and 3D view of your buildings, which helps you map and predict trends, revealing building occupancy throughout the day.

The need to change the old ways of managing buildings is apparent. New ways of working that are information-led; need to replace the old rota-led systems. New ways of making decisions that are informed by multiple views of different data sets will generate exciting new opportunities in businesses that are looking for better ways of working.

Management Challenges in the Big Data Era

Content written by Robert Drake

In business literature few terms get more confused than ‘management’ and ‘leadership’. The two words are often used synonymously but are quite different. Martin Luther King, Winston Churchill, and Ghandi are all regarded as great leaders – does this mean that they were also great managers? No? So why the confusion?

- The terms “management” and “leadership” are used interchangeably without distinguishing the fundamental difference between the two and the vital functions that each role plays.

- The term “leader” in some instances refers to the person at the top of hierarchies, while people in the layers immediately below him/her in the organization are called “management.” Everyone else are; workers, specialists, and individual contributors. This is both wrong and misleading.

- “Leadership” is usually discussed in terms of personality characteristics, such as charisma. Assuming only a few people have great charisma leads to the conclusion that few people can provide leadership, which is not the case.

Thus, we can consider ‘management’ as a series of established processes, such as planning, budgeting, structuring jobs, measuring performance and problem-solving. The objective of management is to better facilitate an organization in doing what it does. This means ensuring that the company produces the products and services as promised, of consistent quality, on budget, day after day, week after week. In all but the smallest and simplest of companies this is an enormously difficult task. In contrast, leadership is about aligning people to a vision, and that means buy-in and communication, motivation and inspiration. Leadership is not about personal characteristics, it’s about behaviour. In truth, while managers must be capable of leadership, leaders don’t necessarily have to be managers. Indeed, today the notion that a

few extraordinary people at the top can provide all the leadership needed is both outdated and unrealistic and has led to many companies being over-managed and under-led. So, should we replace management with leadership?

How an organisation balances management and leadership depends on the business environment in which it operates. In a stable environment, management is essential in mobilising people to do what they've always done and to continue to do it well. Conversely, leadership is about change. When the environment is dynamic and fast-changing, good leadership may be more important than good management. Big data, and the consequential move to analytics, require good management and company-wide leadership. In the next two sections we will examine the *role* of management (what management does) and different *styles* of management (how it does it). In both role and style leadership is an important aspect of management, as you will see.

The challenges of big data (the four Ds)

As we have seen, the role of management is about using established skills and prior experience to make decisions. But what if the skill-set required to do your job changes, leaving you feeling uncertain, isolated and vulnerable? What if the significance of your experience is undermined, leaving you feeling under-valued and at risk? What if your ability to make decisions is continually questioned as colleagues, superiors and subordinates ask, “Where’s your evidence?” What if, like the Emperor in his new clothes, everyone knows more than you..?

Data literacy

In February 2010 Accenture, a major consultancy firm, surveyed 600 companies in the US, UK and Ireland and found that more than 50% of organisations surveyed were “structured in a way that prevents data and analytical talent from generating enterprise-wide insight” (Wilcox 2010). Moreover, only 5% of manufacturers used analytics to support supply chain and resource planning. As we enter the big data era the focus of most management literature is on the potential benefits to the company bottom line. However, this overlooks the fact that, for many executives and managers, mathematics and statistics classes are a distant, long-

forgotten memory. Most will be proficient with spreadsheets but beyond the terms; 'mean', 'mode' and 'median', many will feel quantitatively challenged. In time this will change, as the effects of big data trickle through society, the importance of statistical thinking and analytics will permeate through secondary and tertiary education. Schools and universities will reinforce the role of statistics in their courses and, given the increasing relevance to employment, students will immerse themselves in practical analytical problems. Today's need for "data-literacy" will seem as archaic as yesterday's demand for "computer literacy", but what of today?

Unfortunately, todays executives and managers are faced with a stark choice; learn statistical techniques or work closely with those who already understand them. However, while a number of companies are beginning to up-skill their staff in basic analytical techniques, many managers are choosing to (or being advised to) partner with the 'quants' in their company. Regrettably, for the manager, this can mean significant sharing of information and with it a loss of managerial power. Conversely, Davenport (2013) urges managers to consider themselves as "consumers of analytics" and notes that:

"…*highly analytical people are not always known for their social skills, so this [forming relationships] can be hard work. As one wag jokingly advised, "Look for the quants who stare at your shoes, instead of their own, when you engage them in conversation*".

The demarcation is unlikely to be so easy. Davenport's stereotype of the "stats geek" is not something many highly numerate employees such as researchers, engineers and scientists are likely to relate to. Furthermore, in defining the segregation of duties between the 'manager' and the 'quant', Davenport suggests that the role of the manager is to ask "tough questions":

"Producers [analytical staff] are, of course, good at gathering the available data and making predictions about the future. But most lack sufficient knowledge to identify hypotheses and relevant variables and to know when the ground beneath an organization is shifting. Your job as a data consumer [manager] – to generate hypotheses and determine whether results and recommendations make sense in a changing business environment—is therefore critically important"

Clearly, asking the right question is 'critically important'. However, to imply that a data-illiterate manager is more able to construct a working hypothesis than, say, a data-savvy employee is to value domain-knowledge higher than an instinct and understanding for the data. When Jonathan Goldman, a PhD from Stamford, joined LinkedIn in 2006 he did so with a wealth of

analytics knowledge and experience but very little domain-knowledge. Looking at the data he began to formulate theories and hypotheses that eventually led to the “People You May Know” product and algorithm responsible for getting millions of users connected and engaged with LinkedIn. LinkedIn’s engineering team, for all of their domain knowledge, had failed to join the dots and actually opposed Goldman’s idea.

Ultimately there will be no substitute for learning quantitative techniques and the managers who embrace the shift from hunch to hypothesis will flourish. Those managers that increasingly rely upon the support of a team of quants will see their power slowly, but inexorably, slip away along with their perceived control over information. Perhaps the last bastion of the data-illiterate manager will be the informational role of communication:

“*If you’re a non-quant, you should focus on the final step in the process—presenting and communicating results to other executives—because it’s one that many quants discount or overlook…”* Davenport (2013)

Unfortunately, even here the analytically-challenged manager may find no place to hide. Davenport suggests that analytics is all about ‘telling a story with data’. That perhaps the manager should spend time considering the language and tone to be used, deciding whether the presentation should be narrative or visual. But who decides what the ‘story’ is? Indeed, what if there is no ‘story’? The narrative fallacy (see Chapter 6, Statistical Thinking) arises from a human need to ascribe sequences of facts with an explanation or force a logical link, an arrow of relationship upon them. Where this inherent desire is mistaken is when it increases the impression that we understand what the data is telling us (Taleb 2008). Alternatively, what if there are multiple ‘stories’, multiple interpretations of the data? In this instance the manager becomes an informational gate-keeper with the story chosen owing as much to the managers implicit and explicit biases as the data available. This is the antithesis of big data analytics.

Domain knowledge

What do we mean by ‘domain-knowledge’? The word ‘domain’ refers to (a) what one is master of or has dominion over and (b) the scope or range of any subject or sphere of knowledge (Chambers 2011). By this measure the term ‘domain knowledge’ may be highly subjective. Among his peers, an Englishman may be considered to have gained significant domain knowledge of India from the writings of Rudyard Kipling but to have never travelled there. Conversely, a foundry worker may have a spent a lifetime working on a single stage of the

steel-making process. He may be able to gauge the precise temperature at which the steel should be poured based upon subtle changes of colour, but have no knowledge of why or how this is so. Thus, in discussing domain knowledge we must be very careful to differentiate between expertise and experience. In some jobs the two may appear to be the same thing, in others however there is a world of difference. Contrast the following Oxford English Dictionary definitions:

Experience: practical contact with and observation of facts or events

Expertise: expert skill or knowledge in a particular field

What's the difference? According to Kahneman and Klein (2009) true expertise requires the individual to acquire a skill and this, in turn, demands:

- An environment that is sufficiently regular to be predictable
- An opportunity to learn these regularities through prolonged practice

The game of chess provides a regular, if complex, environment (as does that of, say, physicians, nurses and firefighters) and it is possible to build expertise over time by a constant cycle of recognition and repetition. In contrast, share-dealers, wine aficionados, political pundits and, all too often, managers operate in a non-regular, complex environment. In these instances what we may consider experience lacks the legitimacy of expertise. True intuition, the ability to understand something instinctively, without the need for conscious reasoning, arises from expertise, due to subconscious recognition of the circumstances and parameters of a situation. On the contrary, much of what is considered to be 'management intuition' stems from the validity heuristic (see Chapter 6, Statistical Thinking). Consider that the most common way business schools teach management is to identify successful businesses, isolate "best practices" and train their students to replicate these practices (classic examples of this are the books "Good to Great" (Collins 2001), and "In Search of Excellence" (Peters and Waterman 1982). This all seems pretty intuitive doesn't it? However, as we will see, in non-regular environments performance depends on both ability and chance. Thus, a particular strategy will only succeed for a time and with that strategy some companies will be succeed (the lucky) and others will fail (the unlucky). Ascribing an organisation's success to that strategy may be wrong if you sample only the winners (the Survivorship bias). The real question should be, "How many of the companies that tried the strategy actually succeeded?"

In 2005 Philip Tetlock published a twenty-year study based upon interviews with 284 political/economic 'experts'. Tetlock asked these specialists to assess the probabilities of events likely to occur in the near future. For example; would the status quo be maintained? Would there be more of a particular variable (political freedom, economic growth etc.)? or less of that variable? He also asked how they reached their conclusions and how they evaluated evidence that didn't support their opinions. In all Tetlock collected 80,000 predictions and his findings were overwhelming. The experts' opinions were less reliable than if they had simply allocated similar probabilities to each of the three outcomes. He also observed that those with most 'knowledge' tended to perform worse due to an illusion of skill which bred overconfidence. As Kahneman (2012) notes:

"Claims for correct intuition in an unpredictable situation are self-delusional at best"

Perhaps this is only to be expected. In low-data environments, where information was scarce, expensive or non-existent, individuals with 'experience' (based upon perceived patterns and relationships seen and adopted over a long period of time) were highly esteemed. These were the executives, managers and experts whose opinions of the future were sought, respected and used for planning. But, in the same way that medicine-men and faith-healing has given way to scientific, evidence-based medicine, so hunches, opinions and intuitively-based management decisions will give way to evidence-based decision-making. Conversely, as big data separates authentic experts from their pseudo-expert counterparts, the value of those authentic domain experts will rise and their roles will change. These domain experts are likely to be prized more for the nature of the questions they ask and their interpretation of analytical results than for their opinions.

Decision-making

As we have seen earlier in this chapter, decision-making is a fundamental aspect of management. Consequently, big data is of little value to the organisation unless it informs employees and facilitates better, more evidence-based decisions. However, decision-making is rather more than cerebral consideration, and choice, from a series of alternative. Decision-making is, for many managers, the tacit mode of control (fig 25):

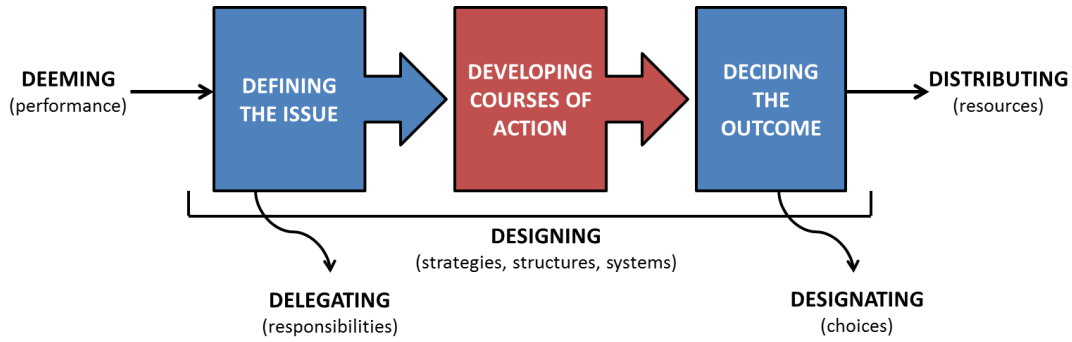


Figure 1: Controlling through decision making (Mintzberg 2011)

Today all of the key "design features", the infrastructure of the company, are determined by the executives and managers. Managers define the purpose of the organisation in order to control employee behaviour (Chapter 2, Strategy), how work divided and allocated to control employee actions (Chapter 3, Structure) and the plans, objectives, budgets and processes in order to control performance (systems). When an issue arises, the manager may decide to delegate the responsibility for resolving the problem to a subordinate. Alternatively, he or she may decide on the final outcome unilaterally. Having decided, through delegation or designation, what the outcome is to be, the manager then chooses how to (formally and informally) resource that outcome. A more hands-off approach may require the manager to set targets for an individual or a team and allow them to perform accordingly (deeming). This is often described as Management by Objective (MBO).

Unfortunately, when making decisions, many senior managers underrate the levels of uncertainty they face. Furthermore, they may be unaware of the decision-making tools available to them, when to use those tools to analyse a decision, or when to delay a decision until it can be framed better. Choosing suitable decision-making tools depends on the executive's interpretation of the challenge being faced and the possible outcomes. Where the executive has a strong causal model, that is an understanding of the critical success factors, the required economic conditions and the desired metrics to be successful and the decision outcome is knowable then conventional budgeting tools are acceptable. However, if there is less certainty regarding the issue and/or there are multiple outcomes (or the outcome is completely unknown) other decision-making techniques are more suitable (table 4):

	Decision Outcome Knowable (Single)	Decision Outcome Knowable (Possibilities)	Decision Outcome Unknowable
Causal Model Known	Conventional capital-budgeting tools	Information aggregation tools + Quantitative multiple scenario tools	Qualitative scenario analysis + Case-based decision analysis
Causal Model Unknown	Case-based decision analysis	Information aggregation tools + Case-based decision analysis	Case-based decision analysis

Table4: Decision-making tools (Adapted from Courtney, Lovallo and Clarke 2013)

- Capital-budgeting tools: use estimated cash flows from potential investments to establish whether a project is worth being funded. They include discounted cash flow, expected rate of return, and net present value models.

- Quantitative multiple scenario tools: analyse decisions by fully specifying possible outcomes and their probabilities. They use mathematical, statistical, and simulation methods to identify the risk/return properties of possible choices. They include Monte Carlo simulations, decision analysis and real options.

- Qualitative scenario analysis tools: develop a series of qualitative scenarios concerning how the present may evolve into the future and then identify the possible consequences of the decision being evaluated.

- Case-based decision analysis: a systematic approach to synthesising information from similar past experiences – those experiences that are most similar to the decision being considered are given more weight in shaping the final choice.

- Information aggregation tools: used to collect information from diverse sources. They include the Delphi method, Crowdsourcing, Similarity-based forecasting etc.

Of course, things are never that simple… These techniques all assume that an executive can accurately determine the level of ambiguity and uncertainty they face. But like all human beings executives and managers are subject to cognitive biases (see Chapter 6), particularly

overconfidence in their ability to forecast uncertain outcomes. As Donald Rumsfeld, the then United States Defence Secretary, at a press briefing during the Iraq war:

"…there are known knowns; there are things we know that we know

There are known unknowns; that is to say, there are things that we now know we don't know.

But there are also unknown unknowns – there are things that we do not know we don't know"

While the comment earned Rumsfeld the 2003 "Foot in the Mouth" Award by the Plain English Campaign for "a baffling comment by a public figure", it underlines the point that, in essence, executives don't know what they don't know, but they're generally happy to assume that they do!

Furthermore, as a result of organisational hierarchy, more and more crucial decisions are being made far removed from the source of information. These decisions, based on managerial intuition and gut-feel, are subsequently justified by carefully chosen data that support the decision. As Gary Hamel (2011) argues, "… [Often] the most powerful managers are the ones furthest from frontline realities" and, in the search for control, managers frequently obstruct decision-making rather than facilitate it. Furthermore, in a typical hierarchy the power to spoil or destroy a new idea regularly rests with one individual, whose personal biases and agenda may distort the decision-making process. The outcome is a hierarchy that disempowers lower level employees, limits their scope of authority and narrows the incentive to contribute.

So, what of big data? Re-visiting his work on leadership in 2013 Gary Hamel wrote:

"…*instead of moving decisions up to where people have expertise, you move expertise down to the people close to the front lines*"

As we have seen, in an era of big data the expertise is *already with* the people close to the front lines. If those people have the information they require and the business skills to use it, all they need is the authority to act, accountability for those actions and a short feedback cycle between the decisions made and rewards received. This is the basis of leadership and at that point the role of many managers becomes defunct.

Finally then, one challenge to executives is to commit the company to training existing employees to increase their data-literacy. Managers should be given the opportunity to up-skill and, as part of the appraisal process, have analytical proficiency targets that have to be met. A second challenge is the recruitment of new staff. Companies need to hire the best and brightest they can afford. At present statistically-savvy Masters and Doctorate students will be difficult to find and, if a company lacks an analytics-based culture, even more difficult to recruit and keep. However, as the hype behind big data fades and analytics become embedded within the core education curriculum, more and more highly numerate graduates will be available. Until then the sector will be dominated by a few highly sought-after, highly paid Data Scientists.

Data Scientists

Davenport and Patil (2012) famously defined the role of Data Scientist as, "The sexiest job of the 21st century", a job that requires a skill set incorporating mathematics, machine learning, artificial intelligence, statistics, databases, and optimisation, plus an ability to formulate problems and engineer solutions. In this section we will focus on the relationship between managers and Data Scientists. Though, before we proceed we need to deconstruct what we mean by 'manager'. So far we have used the terms 'executives' and 'managers' rather loosely, the inference being that 'executives' are at the top of the organisational hierarchy and the 'managers' in the middle. However, the advent of the Data Scientist brings with it different (though closely related) managerial challenges depending upon ones position in the hierarchy. Let's start with the relationship between a mid-level manager, say, the Marketing Manager and the Data Scientist.

For the marketing manager whose company is about to move into the era of big data life has suddenly become rather more uncertain. In addition to the greater scrutiny of her numbers she has also been told that she will be working with a 'data scientist', but what does that mean? As we have seen earlier, the stereotypical view of a data scientist implies someone who is extremely intelligent but lacks social skills and finds communication difficult (a stereotype that Davenport 2013, reinforces). In this case the Marketing Manager may be forgiven for considering her role as that of 'Data Consumer' supported by the Data Scientist as 'Data Producers'. She recognises that she will need some basic analytics training (her last statistics course was on her Marketing degree). That said, her role will be to frame the questions (naturally, this is where her experience and intuition are most important), assess the results

and present the findings to the board. Obviously she will need to ask lots of questions during the process to keep the data scientist focused but the hierarchy, the decision-making power and the control remains unchanged – so why does she feel uncomfortable?

What happens if she can't frame the 'right' initial questions? After all when Jonathan Goldman joined LinkedIn he did so with lots of analytics knowledge but very little domain-knowledge. Indeed, one of the strengths of data scientists, one of the reason they can demand such high salaries, is that they can develop novel, innovative hypotheses. How can she intervene in the process? How can she ask any 'smart' questions if she doesn't understand the process and techniques? How can she evaluate the outcome of the project if she hasn't understood the initial hypothesis, never mind the ultimate outcome? Finally, despite the stereotype, the job description for the data scientist includes presentation, graphics and communications skills, so what does she have to offer? Where will the data scientist fit in the overall organisational structure? Will he work for her, or vice-versa? Will he be in her team? If so, given the salary advertised, how will the rest of the team react? The CEO has said that the data scientist role has a 'high level of autonomy', what does that mean for her interactions with the higher levels of management?

Perhaps our Marketing Manager is right to be uncomfortable, but so should our executive. Many of the questions raised by the Marketing Manager have yet to be addressed at a senior level. As yet there is no consensus on where the data scientist role fits in an organization, how they can add the most value, and how their performance should be measured. Davenport and Patil (2012) note;

"*Data scientists don't do well on a short leash. They should have the freedom to experiment and explore possibilities. That said they need close relationships with the rest of the business*"

The challenge for senior management is how to develop the necessary culture, processes, behaviour, and skills in order for a data scientist to operate without undermining the business at the same time. Mid-level management can, indeed must, be able to partner with data scientists in order for the company investment to yield better strategic and tactical decisions but this relies on them forming strong relationships that allow them to exchange information and ideas easily. Davenport (2013) urges managers to, "align yourself with the right kind of quant!" but 'alignment' can mean many things. Likewise, how can a manager decide what the 'right kind of quant' looks like?

In some companies the move to big data is starting from the bottom-up with some business unit managers trying to push analytics through their departments and on to the rest of the business. Often it starts when a manager somewhere in the organization gets frustrated and decides that “there has to be a better way.” The manager introduces a small-scale big data initiative and gets interesting results. However, what motivation or authority does that manager have to push beyond his or her department? In the end, the company is left with good analytics in a few areas and poor ones everywhere else. Rising above that plateau takes the commitment of senior leadership. For big data, and data scientists in particular, leadership must begin at the top, with the principal sponsor, the CEO.

Connect BI
4 December 2015
Rolls Royce, Derby

#ConnectBI
@Connect_BI

BOOK NOW

ACHIEVING SUCCESS THROUGH

Data analytics

Business intelligence is a tool that all companies need to utilise in order to remain competitive. With a gradual shift towards a digitised economy, servitised business models and heavy reliance on big data, BI is more important than ever.

Connect BI, will provide key insights from leading professionals on how to use BI to improve your business performance. Covering a range of sectors you'll understand how BI can be applied, the different types of software available and what the future of BI will involve.

connect-bi.com

Sponsored by

boardi

eBECS
Experts in Microsoft Dynamics

K3 FDS