PATHWAYS TO VALUE FROM BUSINESS ANALYTICS

Completed Research Paper

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Abstract

Through what pathways does business analytics (BA) contribute to business value? To answer this question we argued that BA tools and capabilities only produce value if they are used, so we set out to explore different types of BA use. This led to the identification of two types of BA users—analytics professionals and analytics end-users (from executives to the shop floor)—which in turn led to identification of the three "pathways to value from business analytics", namely provision of advisory services, creation and enhancement of BA tools and the BI-platform, and use of BA tools by end users. As a preliminary empirical assessment of the validity of these three pathways, we conducted eleven one-hour interviews with thirteen senior managers with a wide range of interests in BA. Results from those interviews are consistent with our claim that the three pathways exist and are important sources of business value from BA.

Keywords: Business analytics (BA), business intelligence (BI), business value, business benefits, success factors, advisory services, decision-making, BA tools

Introduction

Although there are many definitions of both "business analytics" and "business intelligence", in this paper we define business analytics (BA) as the use of data to make sounder, more evidence-based business decisions, and business intelligence (BI) as IT-based BA tools, e.g., statistical and quantitative techniques, explanatory and predictive models, data warehouses, on-line analytical processing (OLAP), visualization, and data mining that enable BA (Howson 2011; Negash 2004). In the past decade, there has been massive interest worldwide in BA and therefore BI. As evidence, BI topped the list of "Technical priorities for CIOs" in Gartner's annual global surveys of CIOs in the three of the five years, 2007-2011 (Hagerty et al. 2012, p. 47). Further, the spate of multi-billion dollar takeovers of BI firms in the past five years, e.g., by Oracle (of Hyperion), IBM (of Cognos and SPSS), and SAP (of BusinessObjects), as well as various vendors' current touting of their in-memory database technologies (IBM 2013; SAP 2011) suggests that vendors believe that BA is likely to make a major contribution to firm performance in the coming decade.

As a way of framing this study, we have reproduced Seddon et al.'s (2012) recent process model of business-analytics use in organizations in Figure 1. According to those authors, the left-hand side of their model "relates to the use of business-analytic capabilities to produce information and insight", and the right-hand side "relates to the use of the organization's entire set of capabilities to produce business value" (p. 3). In this paper, we focus on both (a) the *Use Analytic Capabilities* concept on the left of Figure 1, and (b) two distinct types of business analytics users, namely (i) *Analytics Professionals* and (ii) *Analytics End-Users* (who include both the Analytical Executives and Analytical Employees in Figure 1). However, although we focus on BA users, we also recognize that BA use, per se, is *not* a source of organizational benefits. Rather, it is only when insights from BA use result in decisions and actions, such as those depicted on the right of Figure 1, that benefits from BA start to flow. Thus, in the context framed by Figure 1, the research question we seek to answer in this paper is:

Through what pathways does business analytics contribute to business value?

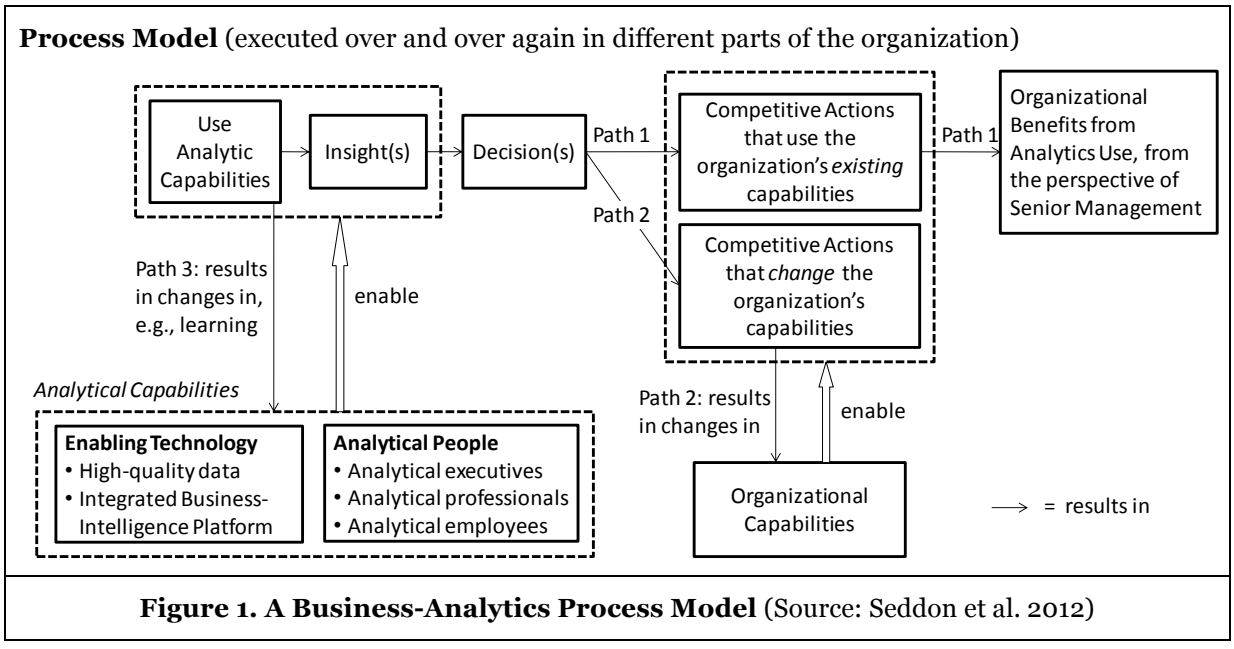

Figure 1. A Business-Analytics Process Model (Source: Seddon et al. 2012)

Perhaps one obvious answer to this question is to point to the three pathways depicted in Figure 1. However, these pathways—with their focus on different types of competitive actions—are not the topic of this paper. Rather, our interest in this paper is in different types of BA users mentioned above and the different roles they play in BA use. Figure 1 actually says very little about BA use. For example, it says that BA use is enabled by Analytical Capabilities, and results in Insights that lead to Decisions, and so on, but

it is silent about the nature of BA use and users. Yet, BA use is obviously key to realizing benefits from BA: because no use means no benefits! Further, it is clear there are many different types of BA use (e.g., drilling down for information on an active dashboard application on an iPad is very different to heavy-duty statistical analysis using a package such as R). Logic suggests that these different types of BA use and users probably contribute to organizational benefits in very different ways. Therefore, our goal in this paper is to present a much richer description of BA users and BA use than that depicted in Figure 1, and to apply insights from this richer description to identify the primary pathways through which different types of BA use contribute to business value.

To achieve these goals, this paper is structured in two parts. First, we present grounds for believing that there are three main pathways through which BA users contribute to realization of business value from BA. Second, to assess the validity of these three pathways, we conducted eleven interviews with thirteen business-analytics experts in Australia. Interviewees were thought leaders with a wide range of involvement with analytics. Our preliminary empirical findings, reported in the second half of this paper, suggest that each of the three pathways is an important contributor to business value from BA.

Two Types of Business Analytics Users

Surprisingly little has been written about the different types of BA users, and the different roles they play in BA use. Apart from early articles distinguishing between hands-on and chauffeured use of Decision Support Systems, e.g., Keen (1980), the only articles that we could find that addressed the issue directly were Davenport and Harris (2007), Davenport et al. (2010), Davenport and Patil (2012), and Accenture (2013). Based on their views, as well as the existence of professional analytics organizations such as The Data Warehousing Institute, the Institute of Analytics Professionals of Australia (IAPA), R user groups, and so on, we argue that there are two distinct types of BA users: Analytics Professionals (APs) and Analytics End-Users (AEUs). These two types of BA users, and the characteristics of their BA use, are described in Table 1 and discussed in more depth in the sections that follow.

Table 1. Two Main Types of Analytics Users

BA User	Description	Characteristics of BA Use
Analytics Professional (AP)	Davenport and Patil (2012) call analytics professionals "data scientists". Typically, they provide evidence-based insights on a range of structured and unstructured questions to an organization's more senior managers. They also guide the embedding of such insights into operational systems.	APs use analytic tools and the scientific method to build (i.e., discover) more accurate understandings of cause and effect for organizationally relevant phenomena, such as revenue and cost streams. This may involve the use of all types of quantitative and qualitative techniques, but in particular, it includes the use of powerful tools for interactive visualization, predictive modeling and data mining, and prescriptive modeling, simulation, and optimization techniques.
Analytics End-User (AEU)	Analytics end-users are business users throughout the organization, from senior executives down to the shop floor. Such people typically have good business knowledge, but frequently do not have strong statistical or analytic skills.	AEUs use capabilities built into BI software to inform organizational decision-making. This may involve the use of conventional reports, spreadsheets, dashboards, scorecards, online-analytical processing (OLAP), and *ad hoc* queries delivered either to the desktop or via mobile devices. Insights from APs, e.g., decisions about market segmentation, may frame the way that information is presented to AEUs.

It is important to point out that BA usage can be classified in various ways, and that our distinction in Table 1—which involves classifying usage by user type—is only one of those ways. For example, the nature of the underlying problem that a BA user is trying to solve can be used as a basis for classifying BA use, e.g., whether the problem is structured or unstructured; or operational or strategic in nature (Gorry and Scott Morton 1971). Although it is difficult to generalize, we would expect APs to be more frequently engaged in solving unstructured and strategic problems, and AEUs with structured problems (whether AEUs' analytic focus is strategic or operational depends on the position of the end-user in question).

Another example is the historical-to-predictive BA classification proposed by Gartner (see Table 2). According to Gartner, in 2012 "most users still focus on measurement of the past, with only 13 percent of users making extensive use of predictive analytics. Less than 3 percent use prescriptive capabilities such as decision/mathematical modeling, simulation and optimization" (Robb 2012). In terms of Gartner's classification, we would expect that APs would be more likely involved with the more-advanced Diagnostic, Predictive, and Prescriptive analytics in Table 2, and AEUs would be more likely involved with the less-advanced Descriptive and Diagnostic Analytics types of BA.

All of the approaches described above have their own merits and provide useful, complementary lenses to examining BA and BA benefit realization. In this paper, we have chosen to focus on the BA-user-based categorization, as we believe this largely unexplored approach holds strong promise in improving and enriching the understanding of how BA benefits unfold. As benefits from BA must flow from BA use, it is important to understand how people in organizations use BA and to identify the various roles associated with BA use that, ultimately, contribute to business value.

Table 2. Gartner's Four Types of Analytics Use

Category	**Definition** (Source: Schlegel et al. 2013, p. 3)
Descriptive	"The vast majority of applications built with BI and analytics platforms to date could be labeled "descriptive" because critical capabilities, such as reports and dashboards, are used to describe the dimensions and measures of a particular aspect of the business. So, for example, a measure such as on-time delivery could be defined in a well-governed data model and enable users to report on the goal and actual value for that measure by various dimensions, such as customer segments or time periods."
Diagnostic	"Increasingly, Gartner sees more organizations building diagnostic analytics that leverage critical capabilities, such as interactive visualization, to enable users to drill more easily into the data to discover new insights. For example, visual patterns uncovered in the data might expose an inconsistent supply chain process that is the root cause of an organization's ability to consistently reach its goal for on-time delivery."
Predictive	"As organizations mature at diagnostic analysis, they become so adept at understanding the root causes in their business processes that they can identify the explanatory variables that predict what the measure will be in a future period. For example, a predictive analytic system could be built to forecast the on-time delivery measure."
Prescriptive	"Solutions can be further evolved to prescriptive analytics as the insights from predictive models are integrated into business processes to take corrective or optimal actions."

It is also important to point out that all BA use relies on the ready availability of both (a) BI platforms and tools within the organization (e.g., data warehouses, data marts, extract-transform-load (ETL) processes, toolsets such as those from both major vendors and open-source providers, and mobile-information-delivery solutions), and (b) relevant high-quality data. Without ready access to both types of resource, BA efforts will be hamstrung and ineffective.

Our objective in this paper is to show that the two types of BA use highlighted in Table 1 require very different human capabilities, and produce benefits through very different mechanisms. With that goal in mind, the two types of BA users and use summarized in Table 1 are now discussed in turn.

Analytics Professionals (APs)

As explained in Table 1, APs major focus is on the use of analytic tools to build more accurate understandings of cause and effect in the organization and its environment. Stated differently, the goal of APs is to use scientific method (Popper 1959) and abduction (Peirce 1903) to build causal models of phenomena that are of interest to the organization, e.g., the drivers of organizational revenue and cost streams. Therefore, APs are sometimes referred to as data scientists (Davenport and Patil 2012).

In terms of competencies, APs are very similar to Ph.D. researchers as they need to have (a) a deep understanding of the context of enquiry, (b) a deep understanding of goals and limitations of cause-and-effect explanations of empirical phenomena (e.g., does smoking cause cancer?), (c) strong computing and data-manipulation capabilities, (d) competence with statistical analysis, and (e) the ability to communicate with business managers to explain how insights from the data potentially impact the business. Although AP duties have been performed in business for many years, e.g., management accountants performing financial modeling to support, say, merger-and-acquisition decisions, the AP as a specialized position is relatively new to business. As a result, there are few degree programs that seek to produce APs.[1]

The roles APs play in BA use may be divided into at least the four shown in Table 3. The first two roles in Table 3 may be termed Advisory, because they involve providing advice to senior business managers who make the actual decisions. (APs do not make these decisions.) The third and fourth role are concerned with building BA capabilities for the use of both APs and AEUs. Here, the AP has much more say in decision-making (although large investments, say, in a SAP HANA or IBM Netezza platform, would of course be subject to normal IT-governance procedures (Weill and Ross 2004)). Of the two latter roles, the "Supervising Development" role involves working with IT-development project teams to develop workable tools or products, e.g., dashboards, for both routine and *ad hoc* use by business users. In some cases, this will involve embedding insights from advisory work, such as customer segmentation insights, into operational processes, such as distinct types of marketing campaigns.

Table 3. Professional Analyst (AP) Roles

AP Role	Description
1. Providing advice on unstructured problems	Conducting *ad hoc* analytical projects, often triggered by an important but broad business question that is not yet fully understood (i.e., addressing unstructured problems (Adam et al. 1998)). A good example would be building a financial model to help decide on bidding price for a proposed corporate acquisition. Another example might involve prospecting, e.g., using data mining tools to try to uncover previously unrecognized patterns in the data.
2. Providing advice on semi-structured problems	Solving more routine problems, e.g., identifying the best way to segment customers for targeted marketing, or developing a credit-scoring algorithm for a bank.
3. Supervising development	Supervising the embedding of BA capabilities, including insights from the first two roles above, into operational systems. Examples might include implementing active-dashboard systems for repeated use by end-users, or supervising the embedding of credit-scoring algorithms for automated decision-making in a bank.
4. BI platform building	Providing advice to the IT function on toolset selection, data warehousing requirements, data quality, data capture from external sources (e.g., social media), etc., and generally working to ensure that a high-quality BI platform is available to support use of BA throughout the organization.

[1] http://datascience101.wordpress.com/2012/04/09/colleges-with-data-science-degrees/ (viewed April 2013) lists some.

Reasons for the business world's current heightened interest in APs are unclear, but they seem to be the result of the convergence of a number of factors, including ready availability of enormous computing power, high-speed access to large data stores (including data from social media), increasing availability of real-time data, e.g., for real-time control of complex processes, increased availability of powerful mobile computing devices such as smart phones and tablets, and perhaps the sense that most of the benefits from the previous computing revolution—implementation of large-scale packaged enterprise application software—have been won, so it is time to turn to greener pastures for IT-based competitive advantage. Whatever the reason, it seems that there is a strong belief in business analytics being "the next big thing", and that APs are the people who will deliver the promised benefits.

Different organizations have experimented with various ways of organizing their APs. Professional analytics capabilities may be placed in business units, in head-office, sourced from consulting firms (e.g., to meet occasional demands for *ad hoc* analyses), or combinations of these approaches (Accenture 2013, Figure 6). In some organizations, the organizational unit responsible for professional analytics is called a "Business Intelligence Competency Center" (BICC) (Accenture 2013, Figure 8). In others it is called a "Business Analytics Team" (BAT) (Elliott 2012).

Finally, it is important to remember that no matter how clever and insightful an organization's APs are, it is only when their insights are applied by the business that benefits flow. If the sponsors of professional analytics lack the organizational clout to exploit insights delivered by APs, or if there are other impediments to action, much money can be wasted on professional analytics activities.

Analytics End-Users (AEUs)

Borrowing from Rockart and Flannery's (1983) term "end-user computing", we use the term *Analytics End-User* (AEU) to refer to the business users of all sorts of BI software. As noted in Table 1, such users may use reporting, spreadsheets, dashboards, scorecards, OLAP tools, and *ad hoc* queries, delivered either to the desktop or via mobile devices. As evidence of the importance of this type of BA use, Accenture reports that in their 2012 survey of 600 executives in the US and UK "who have knowledge of and/or responsibility for analytics within their organization" (Accenture 2013, p. 3), 65% mentioned "self" as one source of analytic talent. Increasingly, it seems, business users in organizations are expected to, and wish to, use analytic tools to help make improved decisions.

Table 4. Analytics End-User (AEU) Roles

AEU Role	Description
1. Self-directed BA use	Conducting self-directed *ad hoc* analytical projects, probably using less sophisticated tools, e.g., spreadsheets and OLAP tools, and more readily available data, e.g., structured data from corporate databases, than those used by APs.
2. Using analytics embedded in routine organizational processes	Using reports, dashboards, and embedded BA functionality (possibly created as a result of insights from APs) as part of routine decision making, e.g., in insurance claims analysis (seeking to prevent fraud) or in conversations with call-center customers. A key point here is that a large investment in BI-platform infrastructure, data extraction, and data quality is needed to enable such routine BA use to be easy and secure for end users.
3. Participating in development projects to guide functionality design	Contributing as power users to the design and specification of analytics capabilities to meet their decision-making needs. An example might include working with the project team to specify KPIs to be reported via dashboards on iPads for repeated use by senior managers.

The simplest end-user BA tools are reports and dashboards, often with active drill-down capability. Such reports and dashboards may have been built in advance by software vendors or implemented through BA projects coordinated by APs. As an example of "canned" dashboard analytic functionality intended for end

users, SAP offers a set of 30 predefined dashboards and reports in its Enhancement Pack 1.0 for their CRM 7.0 software (Anon 2010). Like configuring ERP systems, these can be tailored for organizational use during implementation. Another very versatile end-user BA tool is the spreadsheet. Spreadsheet packages have powerful modeling capabilities, including real-time links to data sources, pivot tables, and Visual Basic macros.

AEU roles may be divided into at least the three shown in Table 4. AEUs are senior executives, business managers, first-line supervisors, and clerks throughout the organization, who are hands-on BA users. They use BI resources when they need data to inform some decision. Such people include Davenport and Harris' (2007), "Analytical Executives" (pp. 135–141) and "Analytical Amateurs" (pp. 147–152) (see Figure 1 this paper), but the bulk of AEUs would probably not describe themselves as analytical anything. They see themselves as business people who use BA tools because they need information to do their jobs.

Finally, as with APs, it is important to remember that no matter how clever and insightful an organization's analytical business users are, it is only when their insights are applied by the business that benefits flow. If they lack the organizational clout, or if there are other impediments to action, their work will not result in much value from BA.

Pathways to Value from Business Analytics

Building on the insights from the above two tables of AP and AEU roles (Tables 3 and 4), in Table 5 we define three "pathways to value" from Business Analytics. Our "pathways" approach to understanding value generation from BA differs from the many previous approaches to explaining benefits realization that researchers such as Wixom and Watson (2001), Watson and Wixom (2007), Clark et al. (2007), Sabherwal and Becerra-Fernandez (2011), Elbashir et al. (2011), Shanks and Bekmamedova (2012), and Seddon et al. (2012) have developed. As discussed earlier, our justification for pursuing the current approach is simply that benefits from BA must flow from BA use, so it seems likely that a good way to understand benefits realization from BA is by understanding how people in organizations use BA, and by identifying how the various roles associated with BA use contribute to business value. Below, each pathway is explained and justified in turn.

Table 5. Pathways to Value from Business Analytics

Pathway	Brief Explanation
1. Advisory services	APs create value by providing *advisory services* to decision-makers. They do this by (a) conducting *ad hoc* analytical projects, often triggered by an important but broad business question that is not yet fully understood (i.e., addressing unstructured problems (Adam et al. 1998)), and (b) by solving more routine problems, e.g., customer segmentation or insurance claims analysis. Advisory services only produce value if decision-makers take action leading to beneficial outcomes.
2. Tool creation	APs also create value by *creating and improving analytics tools* and *embedding analytic capabilities in operational systems*. They do this by (a) supervising the embedding of BA capabilities into operational systems, and (b) providing advice to the IT function to ensure that a high-quality BI platform and quality data are available to support use of BA throughout the organization. Creating such tools and providing such advice only produces value if tools are used, and used effectively, by end users.
3. End-user analytics	End users create value by using analytics tools for evidence-based decision-making. They do this by (a) conducting self-directed *ad hoc* analytical projects using a range of tools, and (b) using reports, dashboards, and embedded BA functionality as part of routine decision-making. A key point here is that a large investment in BI-platform infrastructure, data extraction, and data quality is needed to enable such routine BA use to be easy and secure for end users. End-user analytics only produces value if the information provided leads to better decision-making, and ultimately, actions that lead to beneficial business outcomes.

Advisory Services: Providing Advisory Services to Decision-Makers

The first pathway to value from BA in Table 5 is the result of APs—including third-party (outsourced) providers—providing advisory services to decision-makers throughout the organization. Such services, e.g., advice on customer segmentation, prediction of the likelihood of customer churn, fraud detection, credit-scoring algorithms for a bank, and so on, are provided by APs often using sophisticated techniques and data delivered by the organization's BI platform. Value is created when such advice leads to decisions and value-creating actions (as shown in Paths 1 and 2 in Figure 1) by managers who receive such advice. As with any service provision the key to success is perceived service quality (Parasuraman et al. 1985). Service quality will depend mainly on there being ready access to the BI platform, the availability of high-quality data, and APs having sufficient knowledge of both the business and how to use BA tools effectively. Of course, it is possible that excellent suggestions from APs may fall on deaf ears, or are not actionable for any of a host of reasons. When this happens, such AP advisory services are of little value.

Tool Creation: Creating and Improving Analytics Tools and Embedding Analytic Capabilities in Operational Systems

The second pathway to value from BA in Table 5 is the result of APs assisting with the creation and improvement of analytics tools and embedding insights from professional analytics into operational systems used (possibly not volitionally) by end users. A good example of such embedding of insights from BA into operational systems is provided by Shanks and Bekmamadova (2012). Shanks and Bekmamedova (2012) describe how professional analytics in a large financial institution led to the development of dashboards to assist call-center staff in daily interactions with customers. These dashboards were developed by the organization's IT team based on insights into customer needs delivered by APs. Once implemented, these dashboards were used for months and sometimes years by call-center staff. This "productizing" of insights from APs, resulting in new tools for AEUs, appears to be an important mechanism through which APs contribute to organizational benefits. Although Shanks and Bekmamedova (2012) describe embedding of APs' insights into operational processes, other insights may also be embedded, say, in dashboards used by senior executives. In other words, the new tools created through this pathway may apply to BA usage by staff at all levels of the organization. However, creating such tools only produces value if tools are used, and used effectively.

End-User Analytics: End Users Leveraging Analytics Tools for Evidence-Based Decisions

The third pathway to value from BA in Table 5 is the result of end users using analytics tools for evidence-based decisions. This pathway involves the use of analytics capabilities such as reporting, spreadsheets, dashboards, and OLAP, and tailored tools created by Pathway 2, by managers and staff at all levels throughout the organization, including senior executives. Increasingly, such information is delivered to mobile users. Effective use of BA tools by end users depends on there being ready access to the BI platform, ready availability of high-quality data, and users having sufficient knowledge of how to use the BI platform effectively. As with professional analytics, end-user analytics, per se, is not a source of organizational benefits. Rather, it is decisions and actions by the wide range of different AEUs (see Paths 1 and 2 in Figure 1) that lead to value. Such decisions might lead to improved customer service, better stock planning, fewer loan defaults, investigation of unexpected financial results, etc.

Key Additional Factors Affecting Value Creation

Earlier studies, e.g., Wixom and Watson (2001), Watson and Wixom (2007), Clark et al. (2007), Davenport and Harris (2007), Davenport et al. (2010), Sabherwal and Becerra-Fernandez (2011), Elbashir et al. (2011), Shanks and Bekmamedova (2012), and Seddon et al. (2012) have identified long lists of factors, e.g., organizational culture, analytic leadership, enterprise-wide analytics orientation, well-chosen targets, on-going BA projects, an enterprise-wide BI platform, BA governance, availability of high-quality data, data ownership, etc., that affect organizational benefits from BA. It seems likely that, in addition to the three pathways in Table 5, many of these other factors will affect value creation from BA.

Empirical Research Design

In the previous section we identified three pathways to business value from BA. These three pathways are summarized in Table 5. They, in turn, are based on insights into the various roles of both analytics professionals and end users in working with BA. Those various roles are defined in Tables 3 and 4. As a preliminary empirical evaluation of our thinking, we conducted eleven one-hour interviews with thirteen interviewees from a wide range of backgrounds in BA. All interviews were semi-structured and conducted in Australia in April 2013. The interviewees were highly experienced in BA and a number are regarded as thought leaders, both in Australia and internationally. As shown in the second column of Table 6, they included leaders of BA user groups, practice leaders in both major IT advisory and consulting firms, managers responsible for Australian BA sales of major software vendors, representatives from leading BA recruiting firms, and managers responsible for BA programs in BA-using organizations.

Methodologically speaking, all interviewees were guaranteed anonymity. All interviews were audio recorded and transcribed for analysis. This resulted in 232 A4 pages of transcripts. All eleven transcripts were analyzed by the first author and two were cross-coded by the second author (due to high consistency between coding results, cross-coding of further transcripts was deemed unnecessary). Quotations reported in the following sections are verbatim from these transcripts. Finally, to reduce the risk of misinterpretation of views, copies of this report were circulated to all interviewees.

Table 6. Summary of Expert Interviews

ID	Role	Evidence of the value of...		
		APs		EUA
		Advisory services	Tool creation	
(1)	(2)	(3)	(4)	(5)
I1*	BA recruitment director, leading BA recruitment firm	Y	Y	N
I2*	BA recruitment specialist, leading BA recruitment firm			
I3	BA user group leader and consultant	Y	Y	Y
I4	BA practice leader (AU), global industry research firm A	N	N	Y
I5	BA practice leader (Global), global industry research firm B	N	Y	Y
I6	Partner and BA practice leader (AU&NZ), global consulting firm A	Y	Y	Y
I7	Partner and BA practice leader (AU), global consulting firm B	Y	Y	Y
I8	BA practice leader (VIC), specialist BA consulting firm	N	Y	Y
I9	Vice president (AU&NZ), major global BA software vendor	N	N	Y
I10#	Head of Innovation and Strategy (AU&NZ), major global enterprise software vendor A	Y	Y	Y
I11#	Vice president for BA (Asia Pacific), major global enterprise-software vendor A			
I12	BA practice leader, major global enterprise-software vendor B	Y	N	Y
I13	Analytics professional, large Telecommunications firm	Y	N	N
	Sum of Ys (/11)	7	7	9

*, # – two interviewees in the same interview. The total number of interviews was 11.

Abbreviations: APs = Analytics Professionals; EUA = End-User Analytics

Results

As shown in Table 6, the evidence from the eleven interviews is consistent with the claim that the three pathways in Table 5 are important sources of business value. The "Y"s and "N"s in columns 3–5 of Table 6 indicate whether there was evidence in a given interview that the pathway in question contributed towards business value from business analytics. Out of the eleven interviews, nine provided support for at least one of the AP-related pathways (seven for advisory services and another seven for tool creation) and another nine interviews highlighted the value of End-User Analytics. Detailed discussion of the findings, together with supporting evidence in the form of various quotations, is presented in the sections below.

Evidence for the Importance of the Three Pathways

Before discussing the three pathways, we first provide grounds for the existence of the three pathways. First, the interviews suggested that the two pathways associated with the AP roles, namely, Advisory Services and Tool Creation, are indeed both real and important. Most interviewees acknowledged the existence of these two types of analytics activity, and often focused primarily on only one of them.

For example, a BA practice leader in a specialist consulting firm stated that their company was almost exclusively focused on supporting clients' analytics tool-creation initiatives, saying that advisory-services analytics was "probably not really quite the space we're in" (I8). This suggests that there is a difference between the capabilities required to fulfill the two types of AP roles. The following quote from a BA practice leader of a global consultancy providing both types of BA services is a good illustration of the two different pathways:

> *"I would draw the distinction between analytics that becomes embedded as part of the process and analytics that's done at a point in time for a particular decision. […] Analytics can be very powerful at a point in time to help clients discover value. An example would be looking at a portfolio of products and the pricing mix to look at, for example, are our promotions effective the way we're doing them at the moment? […] That's what we would call value discovery and using analytics to discover an insight. […] It has a beginning and an end, it's for a specific purpose, it's a discreet data set. […] If I take the second part, which is more the process, sustainable, repeatable processes for analytics, that again is a major industry in its own right. And you look at some of the solutions the big IT vendors are bringing to market and you look at the analytics capabilities of those solutions, they're very powerful and they can become embedded in the technology environment and can be automated in many cases." (I7)*

Second, End-User Analytics was also identified as an important pathway to value from BA. A number of interviewees commented on a trend towards more analytics-savvy employees at all levels of the organization. As a result, some activities that have traditionally belonged to the domain of professional analytics are becoming a part of End-User Analytics.

> *"Is analytics a literacy like reading and writing and mathematics was? You know, it used to be the domain of experts, but really now everybody in businesses can read, write and count. […] That's the real debate. Realistically it's not going to be that kind of literacy probably within our lifetimes, but I think that's where it's ultimately headed. Ultimately analytics needs to be everybody's business." (I3)*

> *"Where the analytics is embedded in the business process does make a huge difference. […] Smarter processes or just more informed people that can make better decisions. [I'll give an example of a] federal agency doing casework. […] They did something really interesting. They just took some of the BI components out [of their data warehouse], well not out, but integrated them into the case management environment in the right context and they saw case times reduce by 40%." (I4)*

> *"There's been a bit of a line of thinking that, you know, you need to be a Harvard PhD maths graduate to actually be able do this. […] But actually the greater weight of movement here will be from business people becoming more analytically savvy." (I7)*

> *"[The operational users] actually start to operate like a business manager or business analyst. […]*

> *Instead of having to go to IT and request an ad hoc report because this one doesn't tell them what they want and you're waiting three or four days, they can do their own ad-hoc reporting natively in the system" (I10)*

It is useful to note though that although there was generally strong support for the value of each of the three pathways, some interviewees viewed certain pathways to be more valuable than others. However, we did not find a clear pattern in these claims. Indeed, opinions were sometimes contradictory as illustrated by the following two quotes (the "strategic analytics" and "one-off exercise" below map to our first pathway and "operational analytics" and "productization" map to our second pathway):

> *"I think both are valuable. […] Operational analytics, first of all, is inherently business as usual. It's a way of improving a process that already exists. And it's a way of enhancing or replacing very routine decisions. […] Strategic analytics is transformative, it's about insights. [… It is] much more valuable because it's transformative." (I3)*

> *"[Productization] for me is where the business value is generated. I think the one-off exercise, [if] it's solving a really big problem and it's worth doing as just one-off is fine. But I think you'll get the most value by creating your model, solving the problem, getting into a production state, getting the business using it on a daily basis and then iterating back to check that the model's still running, still producing those results because businesses change quite rapidly." (I8)*

Having established that the three pathways in Table 5 exist, we now discuss the importance of each.

Benefits Pathway 1: Providing Advisory Services to Decision-Makers

Key factors in obtaining benefits from advisory services of APs included (a) appropriate skills of APs, (b) focused questions, and (c) problems in interactions with IT. First, skills mentioned in relation to Advisory Services included business-savvy, communication and interpersonal skills, technical skills around modeling, statistics, and data manipulation, and research skills. For example, in describing his advisory-services role in a major telecommunications company, I13 stated:

> *"In business, I've found nothing more useful in my background than my research training but that's partly also a function of the particular roles that I was given. So the ability to determine a relevant context for the problem you know contextualize a problem and sharpen the problem statement, articulate some questions, interrogate stakeholders as to their particular views." (I13)*

Reinforcing this, a BA recruitment expert (I1), an experienced analyst and consultant (I3), and a BA practice leader in a major global enterprise-software vendor (I12) whom we interviewed described the relevant skills in a similar fashion:

> *"The most successful all-rounder analyst […] would be somebody who technically is very, very strong, he's got that ability to navigate between business problems and understand and derive insight from the data, he's technically flexible. […] It's somebody who has got the technical and academic smarts to be able to delve into the data, be able to develop some really effective analytical solutions but then understand how and why that can be used within a business. Rather than just stop at the numbers but somebody who can actually interpret that information and use that to address a problem or an issue or a solution for a business." (I1)*

> *"[Advisory Service] is much more exploratory. It's much more heterogeneous. […] I think more so than with operational analytics [= our Tool Creation]. [It is] with strategic analytics [= our Advisory Services] that you're really talking about the very exceptional individual. You're talking about someone with very high technical skills, but that's only part of the equation. You're talking about non-technical soft skills and organizational skills and you're also talking about a temperament, you're talking about someone who's a rigorous analyst and also a sort of a very curious experimenter and a sort of a tireless entrepreneur, all in one." (I3)*

> *"Customers are trying to move from doing reporting and simple querying to how do we make more informed decisions? And that requires what we would see as really more a business-orientated analytics person rather than a straight technical person that can perhaps understand the analytics but not always understand what the business outcomes or the business implications*

are. So we see a growing demand for that business-orientated analyst-type person." (I12)

Finally, communication with business people needs to be in a business-friendly language:

"The problems I've seen tend to be the interface between the analysts and the business and it's that, as I said before, the communication and relay of results. I've watched people in presentations try and show business users what lift charts means, what association rules mean, all of the things that the modeler would use [...] The business user, they're just lost with the maths going on." (I8)

Second, APs are sometimes asked to answer very open-ended questions (e.g., What is the best approach for segmenting our customers?). Our interviewees were skeptical about the value potential of such questions. Rather, they suggested that clearly defined questions and a business case are usually essential for maximizing the likelihood of value realization:

"In the big world of how much data is being sent out compared to the value of analyzing that data and getting that insight, you're ploughing through several, several haystacks for that one needle and somebody's got to pay for those haystacks. [...] We're looking for evidence where having insights that are delivered through big data analysis will actually pay for what it took to collect and analyze that data. We're not interested in collecting and storing and churning through the data just for the heck of it." (I6)

"[Here's] a bunch of data, see if you can find something in it. Which we've found just doesn't work. You need to be very, very focused on a problem or problems that you're looking to solve." (I8)

Third, in the context of advisory-services analytics, another frequently mentioned issue was the reluctance or slow responsiveness of the IT function in granting analysts access to data or to the enabling tools. This situation seems to be related to one-off advisory projects, each of which is likely to have unique information requirements as well as potentially different toolsets.

"I've come across organizations a number of times where they said: 'Look, frankly we spend most of our time fighting IT. You know, fighting for data or we can't get R installed, we've been waiting for five months.'" (I3)

"Throughout my whole time I was, generally speaking, begging data [from] the IT community." (I13)

Benefits Pathway 2: Creating and Improving Analytics Tools

Key factors for obtaining benefits from analytics Tool Creation differed from those discussed in relation to Advisory Services in two main ways when focusing on the required skills: (1) less emphasis on research skills, and (2) more emphasis on skills related to organizational processes and IT projects.

"What sort of skills do you need with operational analytics? [...] Well, building predictive models for accuracy, deploying predictive models, building deployable predictive models while making them as accurate as possible. And then what are the soft skills? The soft skills are really all about coordinating with IT. Please give us the data, please don't choke us ('cause IT loves doing that). Coordinating with the trigger-pullers, the end-users. Please use these insights, we're not here to make you obsolete, we're not here to make you feel stupid, this computer thing is here to help you. You know, winning people over, playing all these sort of lateral politics. And then integrating everything electronically as well, getting a whole lot of systems to talk to each other." (I3)

"You've created your model, you've got a great model that you think's going to work and you can sort of prove that but then the next step is to actually be able to what I call productionize and put it into the business systems where you want it to be working. And that also is a level of skill that's required. So you need to understand some of the project methodologies—whether that's using Agile or standard waterfall processes—but you need to take that model and be able to productionize it and help the business use it." (I8)

"[The analysts] are looking for patterns, they're excited about the discovery of it and unlike a lot of other things, once you've developed a particular propensity model, it pretty much stays there. It's not like it's going to change every other day where you've got to tweak it. [...] So they're

> *looking for the next challenge. Okay, so I've built the propensity to buy, the propensity to defect [model]. What else have you got for me?" (I6)*

It is also important that analytical models embedded in software tools provide *actionable* insights:

> *"They've made [the predictive model] so complicated the business users are saying we can't work with it. […] The business were thinking there's five key things that we need to work with to pull levers to get the [customers] to stay but they've made the model so complicated, they're saying there's like twenty. [The] business say there's too many things to try and pull levers around." (I8)*

In terms of value creation, the benefit of analytics Tool Creation over Advisory Services is that once systems are built, operational decisions no longer require the involvement of analytics professionals:

> *"You're an insurance company and you do retrospective utilization reviews of your claims and your analyst may spot certain trends or certain demographics that are most likely to submit those things. And [discovers] you've paid a million dollars over the last year that you shouldn't have. […] But the more valuable part is to use that routine, that algorithm or whatever it was that this guy found or this gal found and say, alright, how about every time we get a claim in, we run it through this algorithm or this engine. […] That way you stop it and analyze it before the money goes out the door." (I6)*

Benefits Pathway 3: End Users Using BA Tools for Evidence-Based Decisions

Key factors in obtaining benefits from End-User Analytics included (a) the trend towards increasingly analytics-savvy end users, and (b) the quality of BA tools, platforms, data, and support structures. First, end users are becoming increasingly competent with analytics:

> *"There continues to be this shift towards… I think the key there is the word competency. And these are just the skills of the people actually using the information itself. […] It's been the world of the business analyst or the financial analyst that has that skill. It hasn't been the result of just the general user within the particular organization." (I5)*

> *"The expectation has moved up the value chain of what self-service means. A few years ago the things that the tools that are being delivered now [are used for], would come out of what's now become fashionably known as the Data Science department […]. If you went back five years and or even maybe a little longer, seven or eight years, and you went to a marketing department and said: 'Tell me about basket analysis,' they'd go: 'What are you talking about?'" (I9)*

> *"[The operational users] actually start to operate like a business manager or business analyst. […] Instead of having to go to IT and request an ad-hoc report because this one doesn't tell them what they want and you're waiting three or four days, they can do their own ad-hoc reporting natively in the system" (I10)*

Second, the quality of the underlying tools, platforms, data, and support structures is very important. This is because end users are time poor, and are not experts in assessing underlying quality, e.g., of data:

> *"BI's becoming humanized, it's becoming accessible and it's becoming trusted. But with that expectation there's also a lot of risk. Because what if you're servicing up bad data, what if you're servicing up poor analytics to those people? You're actually exposing people to make decisions on bad processes. […] BI requires you to have a foundation that is trusted, you have to have one single semantic layer that everyone agrees to, you need to have very strong ETL processes and data management and data governance processes and you need to have your power users that help manage that environment, that never goes away. It's just more people are going to be brought into the BI world now." (I10)*

An Overarching Issue: Data Quality

Lack of access to high-quality data was frequently identified as hindering BA success for all the three pathways.

"One of the big flaws is actually what I was talking about before, the data quality. If you don't understand the value of the actual process of collecting the data, that curation of the data, the old analogy of 'garbage in, garbage out' [applies]. It doesn't matter how good your analytical model is. If your data itself is garbage, and you don't have any trust in it, then the model's not going to tell you anything." (I5)

"There's also the quality of the data that [the analysts] are dealing with. One of the things that a lot of people may or may not want to admit is that a data warehouse almost never improves the quality of the data. It just magnifies the issues of the quality of the data. So it's the ultimate 'garbage in, garbage out' system." (I6)

"Data quality is obviously key and critical, and if you've got tons and tons of missing values it's not going to help. […] We've found typically in the past with some analytics projects that we spend a lot of time preparing the data." (I8)

"We had to work with people from within consumer [area] who were experts in the database of the call records—including their dirtiness—to do this [analysis]. So it actually took me five months to do it. I mean it should have taken me three weeks but it took five months, most of which was getting the data, and three days was doing the analysis." (I13)

Discussion

Our goal in this paper has been to explore pathways to benefits from business analytics by focusing on various roles associated with BA use. Compared to the work of researchers such as Wixom and Watson (2001), Watson and Wixom (2007), Clark et al. (2007), Davenport and Harris (2007), Davenport et al. (2010), Sabherwal and Becerra-Fernandez (2011), Elbashir et al. (2011), Shanks and Bekmamedova (2012), and Seddon et al. (2012), who have all produced models of factors that drive benefits from business analytics, our approach has resulted in a very different view of the mechanisms through which BA contributes to business value.

We do not claim that our approach is better than that of the many authors listed above, but it certainly is different. To the best of our knowledge, few authors—with the exception of Davenport and Harris (2007), Davenport et al. (2010), and Davenport and Patil (2012)—have considered the nature of BA use based on user roles in any depth, and none has proposed pathways to value from BA such as those in Table 5. Further, the empirical evidence suggests that these pathways are both real and important. It therefore seems to us that this pathways approach has much to commend it for future research that seeks to understand how organizations can achieve greater value from business analytics.

In short, the contributions of this paper have been to (a) identify a new and promising way of understanding how business analytics contributes to business value, and (b) provide preliminary empirical evidence that these pathways are real and important drivers of business value from BA. The three pathways in this promising new approach are summarized in Table 5.

Of course, there are many factors other than those in Table 5 that affect benefits from BA use. Long lists of such factors have been identified by the authors listed above, e.g., organizational culture, analytic leadership, enterprise-wide analytics orientation, well-chosen targets, on-going BA projects, availability of an enterprise-wide BI platform, BI governance, ready availability of high-quality data, data ownership, etc. Many of these factors are discussed at length in the above-mentioned books and articles by Davenport and colleagues.

However, in addition to these factors, a number of other important issues emerged during our discussions with BA thought leaders in Australia. These included (a) the opinion that predictive analytics, e.g., predicting likelihood of loan defaults, has lots of promise, (b) the view that much of the "hype" around big data and BA is due to "fear of missing out", rather than huge benefits actually being realized by firms around the world, (c) concerns about poor returns on data prospecting (finding "the needle in the haystack", mentioned earlier), (d) reservations about the "data scientist" label due to concerns that it invites disconnectedness from the business, and (e) concerns about the concept of BA Centers of Excellence (also called Competency Centers), which promise much, but often do not deliver.

Conclusion

In this paper we set out to answer the question: *Through what pathways does business analytics contribute to business value?* Our approach to answering this question was to argue that business analytics tools and capabilities can only produce value if they are used, so we set out to explore different types of BA use. This led to the identification of two types of BA users—Analytics Professionals and Analytics End-Users—which in turn led to identification of the various BA-user roles defined in Table 3 (Analytics Professional roles) and Table 4 (Analytics End-User roles). Finally, consideration of how these roles contribute to the creation of business value led to the delineation of the three "pathways to value from business analytics" summarized in Table 5. Table 5 is thus the answer to our research question.

As a preliminary empirical assessment of the validity of the claims in Table 5, we conducted eleven one-hour interviews with 13 senior managers with a wide range of different interests in BA in Australia in April 2013. Results from those interviews are summarized in Table 6. As shown in Table 6, there was considerable support for our claims that all three pathways in Table 5 are important sources of business value from business analytics. In particular, columns 3, 4, and 5 in Table 6 show that more than half the very senior and experienced managers in our eleven interviews believed that each of the three pathways in Table 5 was an important source of business value from business analytics.

In future research we hope to use the three pathways in Table 5 to build a formal model of factors that drive benefits from business analytics. Such a model needs to take into account the "Key additional factors" mentioned earlier, such as corporate culture, analytic leadership, and so on, as well as the important issue of data quality that emerged so strongly in the course of our interviews. It is too early to speculate on details of such a model, but we encourage other researchers to join with us in investigating this promising "pathways" approach to understanding how BA users and use lead to business benefits.

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