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Big data in Financial Management a structured literature review and Opportunities for IS research

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Abstract

Information Systems to support Finance and Accounting functions within organisations form the backbone of modern commerce. Big data has brought a transformational change to this research space the effects of which are starting to be felt in industry and academia. This paper examines the potential research opportunities for the use of "Big data" in the cross disciplinary space of Information Systems, Accounting and Finance. We examine literature at the confluence of these three disciplines to identify current research approaches. An analysis is presented of 47 accounting and finance and information systems (IS) journals from 2007-2016 to identify key themes emerging. These are presented as a conceptual matrix and explored by means of this matrix and a theoretical framework that situates the emerging themes across the three cogent disciplines. The concept matrix reveals potential areas for further research.

Keywords Big data, Decision Making, Accounting, Finance

1 Introduction

The first commonly cited use of the term "big data" was during an invited talk at the USENIX annual technical conference (Mashey 1999). A straightforward search for the term "big data" shows an exponential growth in publications relating to Big data in the Scopus database in past ten years (see figure 1.) References to the term in the academic literature are more common in biomedical informatics in the early 2000s, and only emerge in accounting and finance literature around 2011.

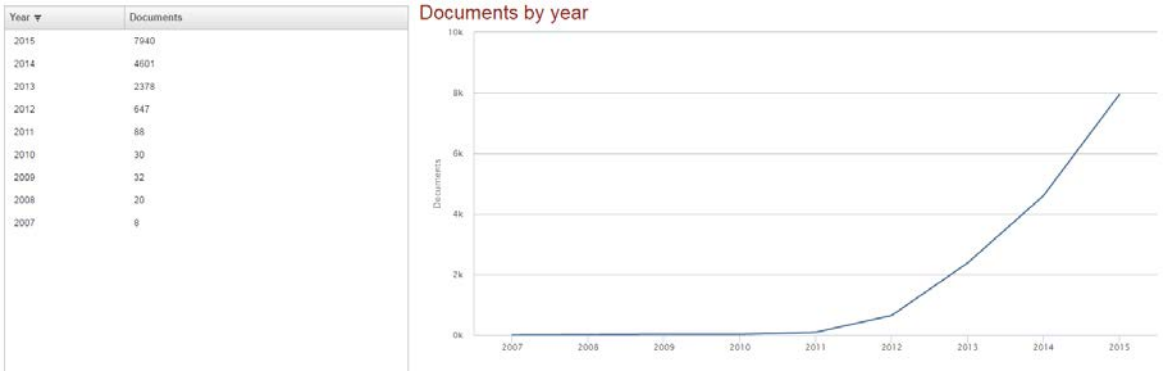

Figure 1 Exponential Growth of "Big data" publications 2007-2015 (all sources and disciplines – Scopus (2016 excluded due to that year being incomplete at time of review)

Big data describes extremely large datasets typically greater than a petabyte (10^{15} bytes) that have particular storage challenges and generally need to be analysed using computational methods.

There has been an increase in the scholarship of big data and a number of useful reviews have emerged (Abbasi et al. 2016; Akter and Wamba 2016; Frizzo-Barker et al. 2016) but notably none focussing specifically on the financial management literature

The use of big data in financial management sits at the confluence of IS, Accounting and Finance disciplines. Most businesses perceive that they can use big data strategically to co-create products with their customers, and to motivate shifts in thinking around data and products leading to increased business value and the monetization of data (Frizzo-Barker et al. 2016). How this applies to financial management is an area of academic and industry interest. Goes (2014) in an MISQ editorial of 2014 made the comment that, despite the extravagant and ambitious claims of many industry commentators many organisations are struggling to make sense of big data. In the same article it was established that whilst giants such as Amazon and Google had their big data strategies worked out, mid-range companies in particular are struggling with the challenge of big data. With respect to such companies Goes claims that "The confusion is exacerbated by the highly fragmented environment of solutions and applications that are intended to work in the big data realm."

1.1. Motivation

The lag of tools and techniques described by Goes is reflected in the work of the European Collaboration BigDataFinance (BigDataFinance 2016). This network of eight academic participants and six companies, representing banks, asset management companies, and data and solution providers claim, on their website that the financial industry is still at an early stage of adopting big data technologies and services, and state that immediate action is required to seize opportunities to exploit the huge potential of big data within the financial world. Further motivation comes from a respected industry report on the use of big data driven by the capital markets. The Thompson Reuters (Aite 2014) acknowledges that the capital markets are at the "start of the journey". The Turner report(Turner et al. 2013) produced jointly by the Said School of Business and IBM noted some advances in the use of analytics in the banking industry, but noted that more than half of big data efforts underway by financial service companies are focused on achieving customer-centric outcomes and that the banking industry lags in terms of using big data and analytics for key analytics capabilities specifically natural language and text processing, geospatial, streaming and voice/video analytics.

From the point of view of IS researchers embarking on cross disciplinary research it is constructive to identify existing work in the area and how this research exploits Information Systems tools and techniques. From there it is possible to identify and gaps in the existing IS literature dealing specifically with finance and accounting topics and the contribution of the IS discipline.

The work presented here identifies gaps in the literature based on a systematic literature review of big data articles with a specific focus on financial management topics. This is achieved by seeking out important themes in the existing research and identifying gaps that provide opportunities for further research

The research question addressed in this work is "what are the major themes in existing research in big data methods for financial management and where are the major gaps in the literature"

Goes (2014) identifies finance as a big data research category typically lacking the technical capabilities to work in the big data environment. We suggest that the finance industry represents a special case having been involved in the analysis of large amounts of data for many years, but being relatively new to data mining and other unstructured analytics methods.

Because of the relative newness of data analytics within the finance industry much of the motivation for this research comes from industry reports which describe big data initiatives and the relative successes of these endeavours. We contend that this is a valid starting point as data analysis in accounting, finance, and banking is a practical discipline with real-world outcomes of note.

Big data exists in a post PC world or Business Intelligence and Analytics 3.0 (BI&A 3,0) as defined by Chen, Chiang, & Storey (2012). Data volumes are increasing exponentially, users are most likely to use mobile devices, much data is turned over to cloud based storage. Chief financial officers (CFOs) are tasked with getting value from stored data (Karlgaard 2011). It is the last point which is fundamental to the role of the finance function within organisations and reinforces the point that data has become a core business asset.

In October 2011 the economist reported that the number of mobile devices surpassed the number of PCs in use (Giles 2011). The fact that these devices are location aware and have ecosystems of downloadable applications opens up new opportunities in in marketing to individuals in locations. Internet enabled devices with sensors that can form part of such ecosystems, the so-called internet of things (IOT).

Marr (2014) identified three areas in which big data analytics provide competitive advantage in the financial services industry namely decision making, customer insights and fraud detection/prevention.

Building on these notions of the financial services industry as a special case and Marr's three way distinction we develop a conceptual framework/taxonomy with reference to Accounting, Finance and IS and theorise around the gaps this framework presents.

The results of this work provide pointers to accounting, finance and Information systems scholars looking for fruitful areas of cross disciplinary research

The paper proceeds as follows; we define the major variables in the study, we then present the search strategy and study selection. Key themes are drawn from these selected studies and suggestions for future research is put forward

2 Financial Data

Big data as defined in the introduction takes on a different slant when applied to financial data. From the organisational perspective financial data includes the standard financial metrics which are well tracked and understood such as assets, liabilities, equity and income. This is a subset of enterprise data which includes broader operational and transactional data that can be used to bolster analysis and forecasting. From an investment perspective data include structured data relating to cash flow such as net present value, internal rate of return and return on investment but also financial statement metrics relating to liquidity, leverage, profitability and valuation. Finally there is the broader view big data which includes all of the above plus new types of internal and external data much of which is unstructured but some of which yields new insights into business performance, risks and opportunities. This more global view of data encompasses social media data.

3 Literature review process

Following the approach of Fergusson and Seow (2011) and Gaunt (2014) an exploratory search was carried out using the term "big data" and the ISSN numbers of all the journals for the field of research (FOR) codes relating to IS, Accounting and Finance within the Australian Business Deans Council (ABDC) list. Whilst this list is aimed at Australian academic audiences, it is comparable to other business centred journal lists worldwide such as the chartered association of business schools ABS list.

Four main business reference sources were used: Scopus, ABI/INFORM and Web of Science and EBSCOhost. The search was limited to peer-reviewed and scholarly journals, and limited to papers published in the ten years between 2007 and 2016, this resulted in 3082 results. Then a filter was applied to only retrieve journals on the ABDC list, resulting in 529 journal articles. However over 300 of these were from IS journals that addressed non-financial topics such as using Hadoop, social media attitudes and analysis of big data in other domains such as health. A practical screen followed to remove book reviews and literature reviews and to focus on papers that explicitly described applications of financial data. The remaining articles were assessed for quality. Thus the search was limited to papers representing field of research codes for accounting of finance, and papers in IS journals were only selected if they explicitly addressed this domain. This resulted in 75 papers which are shown in appendix 1. Although the search encompassed 10 years, all references except one in the data set fall between 2011 and 2016.

4 Research Directions

The 75 papers emerging from the search process serve to highlight the comparative lack of published work in accounting and finance. Journals publishing three or more papers in this period were Accounting Horizons, Business Intelligence Journal, Business Process Management Journal, Information Systems Frontiers, Journal of Accountancy and Internal Auditing. Paradoxically, although the Accounting and Finance disciplines traditionally deal with large volumes of data in their analyses, the actual use of big data, and big data analysis methods in these disciplines is at a very early stage (Scott and Orlikowski 2012). Turner et al (2013) capture this notion of volume with "Big data is especially promising and differentiating for financial services companies. With no physical products to manufacture, data – the source of information – is one of arguably their most important assets. The business of banking and financial management is rife with transactions, conducting hundreds of millions daily, each adding another row to the industry's immense and growing ocean of data" (Turner et al., page 3)

Retail banks and capital markets use customer analytics, to market their products. Evidence of this work, based on marketing and IS theory, is mostly in trade literature and consultancy reports.

Reporting can be enhanced with the use of big data strategies to bring together disparate data sources and expose fraud and suspicious activity via trade reconstruction reporting.

From the point of view of the Accounting profession, many commentators have suggested that the accounting profession is best placed to manage the Big data function within organisations (Bhimani and Willcocks 2014; Brands 2014; Hagel 2013). The reasons given generally centre around three points. The first point concerns, the existing professional trust in accountants. The second point relates to how accountants have the capacity to add clarity to numbers (or make sense of data). Finally commentators argue that there should be a greater role for the accounting profession in analytics and less on cost control as part of performance optimisation.

The actual use of Big data is still in its infancy (Jeacle and Carter 2011; Scott and Orlikowski 2012). Jeacle and Carter (2011) make an interesting point that that review web sites such as trip advisor appear to act as a means of producing trust, and they take place outside of the accountancy profession's orbit. Scott and Orlikowski (2012) build on this, also using trip advisor as an example, to explore what they describe as a burgeoning of "auditable contexts to come up with a model of how accountability is performed online using social media websites.

Big data provides new means of informing decision making and extract value from data more effectively. Implicit in the examples above is a research agenda in accounting that involves how the social media package, already existing in the marketing department of many organisations, might impact on the accounting function. That is, the type of work that involves monitoring and managing an organisation's social media presence internally for marketing purposes could also impact trust and accountability.

Marr's (2011) three pillars, decision making, fraud prevention and customer insights are expanded in Figure 2, this is a representation of where in the literature themes emerge. There is some cross disciplinary blurring, for example decision making which is a core community of interest in IS and accounting. Figure 2 was developed by extracting the main themes found in the 75 articles, using the concept matrix in Appendix 1, and Marr's three pillars. The taxonomy is structured with reference to Accounting, Finance and Information systems. The use of a concept matrix (see Appendix 1) is core to a structured literature review and follows the recommendation of (Webster and Watson 2002).

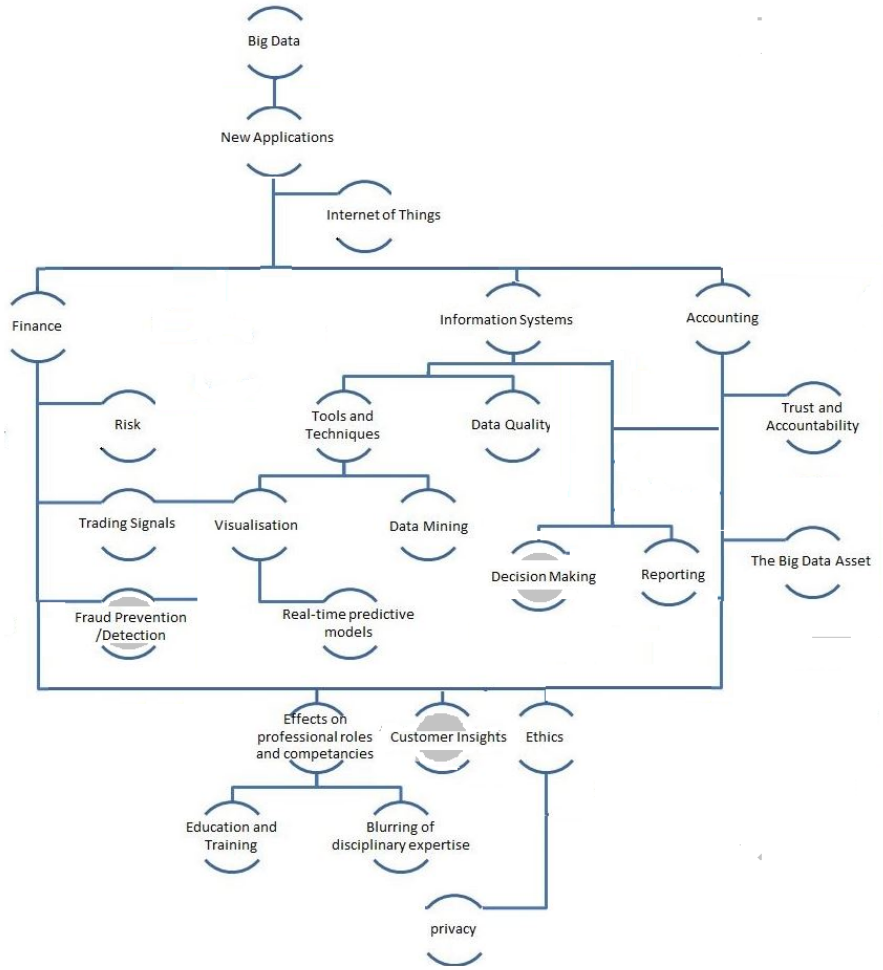

Figure 2 Taxonomy of roles in big data and Finance for the Finance, Accounting, IS and Marketing discipline. Marr's (2011) pillars highlighted in grey.

The remainder of the discussion is structured around this taxonomy

4.1 Risk

Risk is a cross-disciplinary concept. In the sample it emerges as risk in portfolio management (Sharma et al. 2015; Sivaramakrishnan and Stubbs 2013) but also, from an IS point of view, threats to the organisation from repurposing data drawn from multiple sources and basing decisions on them (Clarke 2016). Clarke (2016) is one of the few articles within the dataset that concerns ethics.

4.2 Trading Signals

In addition the google trends work of Preis et al. (Preis et al. 2013), Cicon (2014) developed a model that retrospectively predicts the Dot-com bubble based on text analysis of 134,990 articles using semantic constructs (litigiousness, negative tone, positive tone, and uncertainty). Wu and Brynjolfsson (2014) used Google trends to predict house price trends and sales. Also Dzielinski (2012) developed a measure of economic uncertainty using google trends and used it to detect impacts on the stock market. Gu (2014) used data mining methods to examine the behaviour of investors in virtual communities finding that, to their detriment investors of the same type chat together missing out on the synergies that might occur from more diversity. There is potential for more research in this area around Social Media influences for example the effects of rumour sites about takeovers and dividend or liquidation. Some work on textual analysis has been done in this area (Loughran and Mcdonald 2011; Luo et al. 2013; Nofer and Hinz 2015). Algorithms purporting to predict stock market moves such as "I know first" (2014) use a combination of machine learning via genetic algorithms (survival of the fittest) (Sharma et al. 2015) and AI techniques (specifically neural nets which are widely used in

classification) (Parnes 2015). The authors explain that new data is added daily to the 15 year database this data is used to run a learning and prediction cycle. The models developed from this are then tested on test data. When the algorithm finds best fit, associated with one of the models, that model is selected and applied to new data. Research into this type of system has been underway for some time. These systems do not use unstructured data, they are focused on structured trade data such as incoming trades (symbol, side, price, size, order type, etc. or outgoing trades (new, cancelled rejected, executed) (O'Hara 2014). Nazaruk and Rauchman (2013) explain the use of this type of tool specifically MIDAS and CAT

4.3 Fraud Prevention/Detection

Fraud prevention is a role in big data that crosses disciplinary boundaries, particularly between Accounting and Finance. From and Auditing perspective, Drew (2013) reported on a poll of Accounting professionals who indicated increased concerns for security risks the proliferation of mobile devices and the mass movement of confidential information to the cloud. Thus big data can be part of the problem as well as the solution. A number of researchers have explored the use of big data for fraud protection. In particular (Brennan et al. 2014) described the use of real-time analytics to detect Medicaid fraud.

Ferguson (2012) reported the use of behavioural analytics for fraud prevention, developing an ethnography of a business based on its accounting or clinic management or employers. Big (historical) data was then used to predict how such behavioural antecedents might lead to fraud. A similar approach was used by Chivers et al (2013) to detect insider attacks within organisation, this was also expanded upon by (Huth, Chadwick, Claycomb, & You (2013) in a guest editorial of a special issue of IS Frontiers. Gregory & Muntermann (2014) used a Fraud prevention example to describe the use a design science strategy to implement big data analytics. Hipgrave (2013) described the use of visualisation to pick up “Crash for cash” insurance fraud for contrived car accidents. In the health domain (Srinivasan and Arunasalam 2013) describe two novel applications that leverage big data to detect fraud, abuse, waste, and errors in health insurance claims.

4.4 Tools and techniques

Tools and techniques broadly centre around three aspects; extracting insight from non-financial data, ensuring insight gained from data is used to improve performance, identifying meaningful trends and insights in a mass of data, and intelligent visualisation and reporting of data.

4.4.1 Visualisation

Frankel and Reid (2008) were one of the first to explore the idea of bringing together graphic artists, computer scientists and statisticians to develop enhanced and meaningful ways of portraying data . ”Big” data contains (or has a greater potential to contain) more patterns and interesting anomalies than “small” data. There has not been much work to date in this area though Flood et al. (2016) explore this concept in financial stability monitoring

4.4.2 Data Science, data mining and real-time predictive modelling

The “big” in big data can emerge from the collection method (e.g. sensor data gathered by the minute) or by virtue of having been collected over a long time frame (e.g. transaction data over a 25 year period). Since 1990 computational methods have been developing to serve the needs of the scientific community and the need for higher computational power has driven the invention of more efficient computational codes and triggered the development of new hardware (Raischel et al. 2014).

Today, obtaining data is no longer a problem. Information is there, available for everyone at any time. Given the computational power of today’s computers and clusters, even single research groups can create and store large data volumes. The challenge in today’s research is more often what to do with the data we have. How to manage all the information we have in such large data sources? Which phenomena can we now study?

4.5 Data quality management

Data quality management has always been the preserve of Data Administrators within organisations. Whilst many of the same principles apply (for example Accuracy, Completeness, Timeliness) big data has brought further challenges to data integrity and quality. These challenges include; the integration of data from different databases and silos and ensuring that the business captures reliable, good

quality data in the first place (CGMA 2013). From an auditing perspective (Alles 2015) noted that as big data becomes an essential part of clients strategies via CRM social networking or other approaches, auditors too will have to learn tools and techniques for managing and monitoring this asset. The importance of the management of big data was also described in (Bhimani & Willcocks, 2014). Bizarro and Dacosta (2014) described the data management cycle with resepct to big data

4.6 Reporting and decision making

The growth of big data together with increased processing power, sophisticated algorithms and advanced statistical methods suggest that there should be many opportunities to improve management reporting and understand the connections between financial and non-financial measures. Big data offers the finance professional the possibility of moving into a more strategic, proactive role in business (Chua 2013). These opportunities were explored in a number of studies (Liu and Vasarhelyi 2014; Schneider et al. 2015; Tysiac 2015; Warren et al. 2015). Bhimani and Willcocks (2014) advise caution against reorienting the finance function to harness the potential of big data saying that it had its place in revenue generation, cost containment and product strategies in enterprises. They stressed that enterprises should make their decisions based on verifiable economic transactions and there should be a clear delineation of (information) systems that provide these established capabilities and those that are more exploratory in nature

4.7 Trust and accountability

There is a body of work spearheaded by Vasarhelyi et al. (2014) around the use of Audit tools in the face of big data and the effects this has on the accounting function (Vasarhelyi et al. 2015). Within our dataset this was the most researched area researchers explore security breaches and data leakage (Chiu et al. 2014; Hamami 2014; Huth et al. 2013) issues around auditing in the presence of big data (Becker et al. 2016; Krahel and Titera 2015; Ramamoorti et al. 2016)

4.8 The big data asset

One reason that the volume of data available to organisations today is growing is that there are more possibilities for media entertainment and social networking online. The data generated from these activities is largely unstructured, but much of it is amenable to structuring in an economically purposeful sense (Bhimani and Willcocks 2014). Thus enterprises can extract customer data from public, proprietary and purchased sources, but they can also explore data from net-communities or *smart* data sources. Smart data is a colloquialism for data matching via data points from various sources, such as customer loyalty databases and mobile location data. (Bhimani and Willcocks 2014) suggest that the type of data matching approaches used by Amazon and EBay to refine user searches could be used within corporations to develop more rigorous data analysis and mining whose results can point to altered pricing policy, cost containment prioritisation and cash and working capital management strategies. A number of researchers also promoted accountants as the natural custodians of the big data asset (Hagel 2013; Lawton 2015)

4.8.1 Customer Insights

Whilst in the marketing literature there is much discussion of customer profiling and closed loop marketing and recommender apps that market to individuals there has been less academic reporting of the marketing of financial products and the impact of this. Another side of customer insights is the use of big data to measure and manage customer satisfaction in the way that trip advisor and other applications do. Companies use traditional measures such as customer satisfaction when searching in unstructured data for patterns. Research might be used to identify new frames of reference – such as customer networks of influence. The use of customer insights is quite mature in the finance industry (Fanning and Grant 2013; Marjanovic and Murthy 2016; Shanmugam et al. 2015; Yu et al. 2015). In this context authors have noted the impact of IOT in this regard in particular Shanmugam (2015) notes that with ubiquity of smartphones and smartwatches the ability to enhance the ATM experience and avoid debit cards altogether. Retail banks have also begun to place sensors in stores that suggest discounts and recommendations via such smart devices.

4.9 Skills shortage

In their big data and impact review paper Chen, Chiang, & Storey (2012) quote Hal Varian, Chief economist at Google on emerging opportunities for IT professionals and students in data analysis as saying

"So what's getting ubiquitous and cheap? Data. And what is complementary to data? Analysis. So my recommendation is to take lots of courses about how to manipulate and analyze data: databases, machine learning, econometrics, statistics, visualization, and so on"

In October of 2012 Davenport and Patil published the much cited article in the Harvard Business review dubbing the role of the Data Scientist as the "Sexiest Job of the 21st century" (Davenport and Patil 2012). Along with blurring of professional boundaries, a skill shortage is emerging which universities and other training institutes might strive to fill. The problem currently is that defining data science is quite difficult to do, (Provost and Fawcett 2013)'bimodal athletes' (Court 2012) are essential.

"Data science to serve business effectively, it is important (i) to understand its relationships to other important related concepts, and (ii) to begin to identify the fundamental principles underlying data science. Once we embrace (ii), we can much better understand and explain exactly what data science has to offer. Furthermore, only once we embrace (ii) should we be comfortable calling it data science. In this article, we present a perspective that addresses all these concepts. We close by offering, as examples, a partial list of fundamental principles underlying data science" (provost,2013)

5 Conclusion and discussion

Widely researched areas are the use of big data to develop models of trust around reputation such as seen in customer service oriented industries such as tourism. Banking and finance industries have embraced customer analytics. Also trade signals and big data methods for fraud prevention are receiving some research interest. Academic and industry commentators have made much reference to the skills shortage in data science.

The five most obviously under-researched areas in financial management and big data are privacy and ethics, data visualisation particularly with relation to data mining and predictive analytics, managing the big data asset in terms of data quality. We set out to poll the existing literature (trade and otherwise) for themes around big data in financial management. We then focussed in via a structured literature review on themes that had been taken up in the quality literature.

Topics that emerged from the concept matrix include research into the Internet of Things particularly with respect to the use of web enabled devices by banking customers.

One of the limitations of our sampling methodology was that it did not capture conference publications, also if it did not appear on the ABDC list it was not included. However we have drawn on literature outside the framework to support our discussion. Since big data is a live and relatively young area of research future research building on this should take conference papers into account.

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Appendix 1 (complete bibliography available on request)

	Techniques and Processes				Information Governance				Privacy Security Ethics				New Applications			Marketing	Professional Roles and Competancies
	Predictive models	visualisation	data mining	Reporting	Data Quality	Data Management	The Big Data Asset	Trust and accountability	Privacy	Security	Ethics	Risk	Trading Signals	FraudPrevention	Internet of things	Customer insights	Education and Training
Discipline	IS	IS	IS	AC	IS	IS	AC	AC	ALL	ALL	ALL	FIN	FIN	FIN	IS	IS	ALL
(Aldridge, 2014)													x				
(Alles, 2015)				x												x	
(Anonymous, 2015)																	x
(Becker, Delfmann, Dietrich, Steinhorst, & Eggert, 2016)								x									
(Bhasin, 2014)																	x
(Bhimani & Willcocks, 2014)				x			x	x									
(Bhimani, 2015)						x	x	x							x		
(Bizarro & Dacosta, 2014)						x						x					
(Blackburn, 2015)								x	x	x							
(Boyd & Crawford, 2012)											x						
(Briggs, 2013)																	x
(Cannon, Godwin, & Goldberg, 2012)																x	
(Cao, Chychyla, & Stewart, 2015)														x			
(Chiu, Liu, & Vasarhelyi, 2014)								x									
(Chivers, Clark, Nobles, Shaikh, & Chen, 2013)														x			
(Clarke, 2016)											x						
(Cochrane, 2012)																x	
(Cochrane, 2016)															x		
(Del Giudice, Campanella, & Dezi, 2016)															x		
(Demirkan & Delen, 2013)						x											
(Drew, 2013)									x	x		x		x			
(Drew, 2015)										x		x					
(Dzielinski, 2012)												x					
(Fanning & Grant, 2013)																x	
(Frisk, Lindgren, & Mathiassen, 2014)	x																
(Gangotra & Shankar, 2016)																x	
(Goh & Sun, 2015)																	x
(Gu, Konana, Raghunathan, & Chen, 2014)													x				
(Guthrie & Parker, 2016)																	x
(Hagel, 2012)																x	
(Hagel, 2013)							x	x									
(Hamami, 2014)										x							
(Hipgrave, 2013)														x			
(Huth, Chadwick, Claycomb, & You, 2013)												x		x			
(Jeacle & Carter, 2011)																x	
(Krahel & Titera, 2015)								x									
(Kshetri, 2016)																x	
(Lawton, 2015)							x										
(Liu & Vasarhelyi, 2014)				x		x											
(Loughran & Mcdonald, 2011)	x												x				
(Luo, Zhang, & Duan, 2013)													x				
(Ludwig, Feuerriegel, & Neumann, 2015)	x																
(Marjanovic & Murthy, 2016)																x	
(Markus, 2015)			x								x						
(McGann, 2013)										x				x			
(Moffitt & Vasarhelyi, 2013)				x		x											
(Nasar & Bomers, 2012)								x									
(Nguyen, Stockdale, Scheepers, & Sargent, 2014)						x											
(Nofer & Hinz, 2015)													x				
(O'Hara, 2014)													x				
(O'Leary, 2013)															x		
(Parnes, 2015)													x				
(Ramamoorti, Agarwal, & Nijhawan, 2016)								x									
(Rayna, Darlington, & Striukova, 2015)																x	
(Schneider, Dai, Janvrin, Ajayi, & Raschke, 2015)	x			x				x									
(Scott & Orlikowski, 2012)								x									
(Seethamraju, 2012)																	x
(Shahpasand, Shajari, Hashemi Golpaygani, & Ghavamipoor, 2015)										x							
(Shanmugam, Wang, Bugshan, & Hajli, 2015)																x	
(Sharma, Thulasiram, & Thulasiraman, 2015)													x				
(Singh & Best, 2016)		x												x			
(Sivaramakrishnan & Stubbs, 2013)												x					
(Tetlock, 2007)													x				
(Trequattrini, Shams, Lardo, & Lombardi, 2016)															x		
(Tysiac, 2015)				x				x									
(Vasarhelyi, Warren, Teeter, & Titera, 2014)				x				x									
(Vasarhelyi, Kogan, & Tuttle, 2015)				x				x									
(Vincent & Higgs, 2016)								x				x					
(Warren, Moffitt, & Byrnes, 2015)				x													
(Werther, 2013)												x					
(West & Bhattacharya, 2016)														x			
(Wigan & Clarke, 2013)									x								
(Williams, 2014)				x													
(Xingze, 2011)	x																
(Yu, Li, & Chantatub, 2015)																x	
	75	5	1	1	8	2	6	4	15	3	6	3	8	9	8	5	12	6

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