# Incorporating big data in audits: Identifying inhibitors and a research agenda to address those inhibitors

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## ARTICLE INFO

## ABSTRACT

With corporate investment in Big Data of $34 billion in 2013 growing to $232 billion through 2016 (Gartner 2012), the Big 4 accounting firms are aiming to be at the forefront of Big Data implementations. Notably, they see Big Data as an increasingly essential part of their assurance practice. We argue that while there is a place for Big Data in auditing, its application to auditing is less clear than it is in the other fields, such as marketing and medical research. The objectives of this paper are to: (1) provide a discussion of both the inhibitors of incorporating Big Data into financial statement audits; and (3) present a research agenda to identify approaches to ameliorate those inhibitors.

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## 1. Introduction

### 1.1. Increasing interest in Big Data by auditors

A survey by Gartner (2014) found that 73% of respondents had invested or planned to invest in Big Data in the next 24 months, up from 64% in 2013. Corporate investment in Big Data is growing from $34 billion in 2013 to $232 billion in 2016 (Gartner, 2012). Likewise, accounting firms are declaring that Big Data is increasingly essential part of their assurance practice.[1] For example, EY states: "*The audit of the future will bear little resemblance to the traditional audit CFOs are accustomed to receiving today. In fact, the way organizations conduct audits will change more in the next 5-10 years given the evolution of technology and analytics. Data analytics, new technology and access to detailed industry information will all combine to help auditors better understand the business, identify risks and issues and deliver additional insights. Moreover, the ability to review and analyze entire sets of data, rather than applying sampling techniques, will help bring more confidence to the audit.*"[2] Similarly, Deloitte Chairman and CEO Joe Ucuzoglu writes: "*At Deloitte we're investing several hundred million dollars in data analytics and artificial intelligence with some cutting-edge applications that we really believe differentiate us and our audit approach. When we use these tools, we're able to get*

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[1] Although accounting firms could conduct a wide variety of engagements under a variety of professional standards; this paper focuses on financial statement audits conducted in compliance with the Statements of Auditing Standards (SASs) published by the AICPA, Auditing Standards (ASs) published by the PCAOB, and International Standards on Auditing (ISAs) published by the IAASB.
[2] http://www.ey.com/GL/en/Issues/Managing-finance/EY-cfo-need-to-know-future-of-audit?preview&HL=CON-USDD-9XAN4E&utm_source=eycom&utm_medium=homepage_PF&utm_campaign=Future%20of%20audit#introduction. Accessed 9/1/2015 1:26:52 PM.

| | Data Analytic Techniques | |
|---|---|---|
| | **Traditional** (Excel, ACL, Idea) | **Extended** (Visualization, Predictive analytics) |
| **Data Sources** **Traditional** (Accounting & Financial) | A | B |
| **Extended** (Non-Financial Data ➡ Big Data) | C | D |

Fig. 1. Paths to expand data analytics in financial statement audits.

greater coverage. We're able to more quickly identify risks. We're able to complete the audit with a higher level of quality and ultimately deliver a greater level of insight to our clients."[3] PwC is undertaking a pilot study of ten audit clients to which they are applying Big Data techniques.[4] PwC audit partner Mary Grace Davenport states that it inconceivable that auditors would not use Big Data when the marketing departments of their clients rely so heavily upon it.[5]

The year 2015 saw a sharp increase in Big Data presentations and publications by accounting academics and accounting practitioners. The June 2015 issue of *Accounting Horizons* had a special issue that included six commentary articles on Big Data. In September 2015, the American Accounting Association (AAA) organized their inaugural *Accounting IS Big Data* conference in New York City. The conference had over 200 attendees with a mix of academics, practitioners, and vendors. The 2015 AAA Annual Meeting and the subsequent 2016 Audit Midyear Meeting and AIS Midyear Meeting included several Big Data paper presentations and panels.

What is notable, however, is that most of these presentations and publications were not specifically about Big Data—at least as Big Data is commonly defined by experts outside accounting (we shall discuss these definitions in Section 2 below). The vast majority of the presentations and panels were actually discussing data analytics of essentially traditional accounting data. Data analytics is not Big Data, though, and traditional accounting data is not Big Data. When discussing Big Data in an audit context, it is important to differentiate between more of the same kind of data that auditors are already using, or more data of a different kind than what auditors have traditionally relied on to give an audit opinion. The former approach would lead, for example, to continuous auditing where the scope of data is not necessarily expanded but measurements are taken more frequently in time (Kogan et al., 2014). By contrast, Big Data pushes the domain of data far outwards from financial data to non-financial data (NFD)—from structured to unstructured data and from inside the organization to outside it—to an extent that may well be outside the comfort zone and technical capability of the current audit profession.[6]

This confusion about what the term Big Data encompasses is not uncommon even in the technical disciplines, with IBM researchers Zikopoulos et al. (2013) writing, "…the term Big Data is a bit of a misnomer". The real value of (the real interest in) Big Data is the value of the analytics that can be performed with that data—the ultimate insights gleaned from the data.

While Big Data and data analytics are two independent concepts, these two concepts can be interrelated. Fig. 1 illustrates how these two concepts can be related in the audit domain. For many years accounting firms have been comfortably operating in Cell A using traditional data analytic tools (e.g., Excel, ACL, and Idea) to analyze samples of accounting data. As illustrated in Fig. 1, based on practitioner presentations at 2015 and 2016 AAA meetings, accounting firms have started moving into Cell B and moving away from sampling (commonly referred as taking a 100% sample). Data visualization tools in particular, such as Tableau, are growing in popularity as an audit tool. But the focus is still on traditional accounting data and performing traditional audit procedures, such as locating duplicate invoices. Although there has been some mention by practitioners of using social media analysis as part of an audit, and thereby moving into Cell C, it appears that there is far less movement into Cell C. Cell D would be truly incorporating both Big Data and advanced data analytic tools as part of an audit. Although accounting academics discuss the broad advantages of Big Data and practitioners mentioned Big Data in a positive light in their presentations and publications, the actual use of Big Data is far beyond current audit activities.

However, as Moore (2002) illustrates (see Fig. 2), there are hurdles that must be overcome in any technology innovation diffusion within organizations. Moore's "adoption chasm" is a popular framework in the technology adoption literature. These chasms represent barriers or inhibitors to the adoption of a technology between different types of technology adopters that can help explain why a technology implementation can suddenly stop growing at accounting firms. The most challenging chasm is between Early Adopters and Early Majority, or characterized another way, between Visionaries and Pragmatists. As those latter names imply, visionaries enjoy testing new technology and speculating about what the future implementations could be like, while pragmatists do not get excited

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[3]   http://www2.deloitte.com/us/en/pages/audit/articles/deloitte-prepares-firm-for-audit-of-the-future-accounting-today-article.html. Accessed 9/1/2015 1:32:53 PM.

[4]   Discussion by PwC partners at American Accounting Association annual meeting in Atlanta, August 2014.

[5]   Discussion by PwC partners at American Accounting Association annual meeting in Atlanta, August 2014.

[6]   For example, a senior technical partner at a Big-4 firm known for its statements extolling its commitment to the use of Big Data in auditing, told the authors that in reality the firm focusses almost entirely on structured data and not what he and others consider to be true, unstructured, Big Data,