Applications of Big Data Analytics in Financial Auditing - A Study on The Big Four

Completed Research

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Abstract

Big data analytics (BDA) is being applied intensively in many industries to gather, transform, and analyze enormous datasets to identify patterns, support arguments and decisions. However, the auditing industry seems to be lethargic and reluctant to embrace the potential BDA might bring to the auditing work. It is understandable that a sector with such stern regulations and tight control will tend to hold a conservative and cautious attitude toward new and infant technologies. In this paper, we have used a mixed method approach through, first conducting interviews with front-line auditors, and second, conducting a survey in the Big Four auditing firms in Taiwan. This study provides a preliminary understanding of auditors’ perceptions about applying BDA into financial auditing and recognize the hidden components that facilitate or hinder the adoption of BDA. Based on our findings, a recommendation of the business approach on how other auditing firms can take to fasten the process of integrating BDA into their auditing practices and the methods to reduce the barriers associated with it is presented in this study.

Keywords

Big Data, Auditing, Financial Audit, Challenges, Opportunities.

Introduction

Ernst & Young (2017) states that the audit of the future will bear little resemblance to the traditional audit work companies are currently accustomed to conducting now. The future audit practices will evolve as the technology innovates and transforms the way traditional auditing works. Vasarhelyi et al. (2015) argue strongly that big data matters fundamentally because it changes radically what we mean by information. As accounting is a field of data, information processing, measurement, analysis and reporting, auditors have a focal role to play in big data analytics (BDA) (Liu & Vasarhelyi, 2014). In addition, the Institute of Chartered Accountants in England and Wales (ICAEW) (2014), acknowledges that the accounting practitioners can engage with big data analytics in numerous aspects such as: using predictive models and other sources of data to improve budgeting and forecasting; conducting more sophisticated exception examination to improve internal control and risk management; and improving the efficiency and quality of audit activities through analysis of entire data sets. Based on a survey conducted by the Financial Supervisory Commission (2016), the attention of the management of auditing firms will be centered on improving the quality of their service to clients and reinforcing the cultivation of the professional skill of personnel. Moreover, the leading challenge among managers and partners is the environment imposed by peer competition.

The decision to conduct this study was determined by the relevance for both academics and practitioners. Since incorporating BDA into auditing is a relatively new topic in the sector, current literature is mostly concentrated on exploring the potential impact and how the future of auditing will be shaped by the use of BDA. Ailes (2015) argues...
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that big data will force auditors to correspond to clients’ implementations of big data projects, and that the “constraints of history and legal culture” will present significant roadblocks to the profession. Brown-Liburd (2015) also suggests that more research is necessary to understand the effects of moving away from traditional audit procedures to leverage the benefits of BDA and how the use of more advanced data analytics will affect the auditor’s judgment.

The aim of this paper is twofold. First, we aim at understanding the current applications of BDA in the audit practice among the Big Four accounting firms (Ernst & Young, Deloitte & Touche, KPMG, PriceWaterhouseCoopers) in Taiwan. And second, to attempt to identify the issues that influence the BDA implementation process.

The main research question of this paper is:

- What is the current BDA applications in financial auditing and how to further improve it?

To find out the answer to this question, the following sub-questions are also investigated:

- What is the common understanding of BDA among audit firms?
- What are the characteristics of BDA in financial auditing?
- What are the pros and cons that are related to BDA applications?
- What is the potential impact of BDA on auditing?
- What are the approaches that can help audit firms to achieve their goal?

Theoretical Background

Big Data Analytics

BDA has already been introduced and applied in various industries to help formulate business strategies and decision making and become one of the most critical management developments in business practices (Vasarhelyi, Kogan, & Tuttle, 2015). Big data is more than the size of the data (Elragal & Haddara 2014). There are other important attributes that make up big data. Typically, big data is depicted with three characteristics (in other studies 7): volume, velocity, and variety (Haddara & Larsson 2017; McAfee & Brynjolfsson 2012). Volume indicates the size of the dataset; velocity is about the speed of data generation, and the variety refers to the diversity of the types of data. BDA is the combination of big data and data analytics techniques and refers to the process of collecting, inspecting, cleaning, transforming, and modeling big data to explore, identify and communicate valuable information patterns, confirm hypothesis and aid decision-making (Haddara & Larsson 2017). The properties of BDA have facilitated the advanced analytics for the purpose of constructing a picture of an event, a scenario or objects of interest from pieces of trivial information that are scattered across different databases (Vasarhelyi & Moffitt, 2013). Outliers that are previously overlooked and abandoned will again be incorporated as a part of a complete model (McAfee & Brynjolfsson, 2012). In other words, in BDA, noises become potential insights.

Distinction between Data Analytics and DBA

In current audit practices, data sources are mostly transactions and account balances that usually reside in the entity’s transactional systems (e.g. ERP) or data warehouse systems. Those data are not big data unless they are accumulated or are complemented with the additional characteristics mentioned above. The distinctions between data analytics and BDA are presented below.

- **Data Coverage and Versatility**

First, it is essential to understand and differentiate between more of the same kind of data auditors are relying on to engender auditing opinion and more of a different kind that auditors have yet to leverage. The former one will give rise to auditing practice in which the scope of the data is not necessarily expanded, but measurements are taken more frequently (Kogan, Alles, Vasarhelyi, & Wu, 2014). Figure 1 presents the different levels of data coverage. Financial data incorporates standard financial metrics, whereas the enterprise data include financial data plus broader operational and transactional data that may be used to generate analysis and forecasting (Gamage, 2016). 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 (Alles & Gray, 2016).
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Figure 1: Different levels & scales of data in audit firms. Adapted from CGMA (2013).

- **Data Processing Techniques and Usage**

While most financial data is structured and similar in formats, data sources of BDA are versatile, and each of them collects information in different forms and structures. Thus, that massive amount of information needs to go through a process called “datafication” (Mayer-Schönberger & Cukier, 2013), which will keep track of thousands of simultaneous data inflows in real time and coordinate data points from text, image, sounds, and videos. Then those data will be gathered, cleaned, transformed and trained by the use of statistical algorithms and other models. As discussed earlier, the usage of data is distinctively different between conventional data and big data. From a financial auditing perspective, the difference is even wider, as auditors focus, most of the time, on financial data even when other forms of data are available due to the lack of the awareness and skills to leverage those data. A survey by KPMG (2014) revealed a shocking reality that 85% of the managers admitted that one of the biggest challenges was figuring out how to make use of the data they collected. If audit practitioners already have difficulties in deciding how to leverage the financial data at hand, this dilemma implies that it will be more challenging for auditors to handle the data generated from outside of their knowledge base.

**Limitations of Traditional Data in Financial Auditing**

In current audit practice environment, most of the auditing evidence originates from digital information, which can be divided into two types: internal and external, depended on the sources and providers of the data. It can also be distinguished as structured and unstructured data by the format of the data. Table 1 below illustrates the level of data usage under the two different circumstances.

<table>
<thead>
<tr>
<th>Source</th>
<th>Traditional data</th>
<th>Big Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial data (Structured)</td>
<td>Internal: High</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>External: Medium</td>
<td>High</td>
</tr>
<tr>
<td>Non-financial data (Unstructured)</td>
<td>Internal: Medium/Low</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>External: Low/None</td>
<td>High</td>
</tr>
</tbody>
</table>

**Table 1: Levels of Data Usage**

The traditional transaction processing systems usually prepare structured and bound data, which is limited in size with delimited boundaries (Moffitt & Vasarhelyi, 2013). For a long time, auditing firms have been performing auditing practices with traditional data analytics tools, such as Excel, ACL, and Idea. Auditors need to select a portion of the data from the entire datasets based on materiality and professional judgment as samples for analysis. According to AICPA (1988), employing non-financial information as part of the analytical procedures can provide an independent benchmark for evaluating financial statements. While some of the auditing firms are beginning to utilize non-financial data and data visualization tool like Tableau, to serve as complimentary audit evidence, the focus is still on conducting standard auditing procedure like attaching duplicated invoices (Alles & Gray, 2016). Nonetheless, there is a range of limitations that traditional data analytics is difficult to surpass. Following are three limitations that are of concerns: 1) Data sufficiency, 2) data reliability, and 3) timely relevance.

**Pros and Cons of BDA applications in auditing**

BDA is projected to fundamentally transform how accounting data is understood and reported (Griffin & Wright, 2015). Warren et al. (2015) state that BDA gives companies new opportunities to identify behaviors correlated with
outcomes and the ability to formulate, store and analyze new performance measurements. Even though many business cases existing in other fields where BDA is applied received huge success, the impact of BDA application in auditing still require thoughtful discussion owing to the professional protocols that practitioners have to conform to.

Methodology

The main constructs of this study have been identified and established based on the literature review conducted for this research. This conceptual model (fig. 2) demonstrates the constructs and how each variable interacts with others, and the influence on realizing the impact when applying BDA into the auditing practice. Based on the review and the conceptual model, this research has employed a mixed method approach (Bryman, 2012). First qualitative exploratory research approach was conducted via a multiple case study in large accounting firms. Exploratory research is a satisfactory method for investigating and explaining why certain phenomena occur (Yin, 2009). Interviews as a data collection method can be used to elucidate information and knowledge from individuals about their own experiences, beliefs, or opinions (Bryman, 2012). Interviews can provide the foundation for background information or tap into the expert knowledge of an individual. In this study, the authors adopted semi-structured interviews design. All the interviews were face-to-face interviews and were conducted by the second author at three of the Big Four organizations in Taiwan, as depicted in table 2. The interviews were digitally recorded and conducted in Mandarin. The interviews were later transcribed and then translated to English. The selection of the cases followed an opportunistic sampling strategy (Patton, 1980) in order to incorporate several large accounting and auditing firms to understand the BDA application difference among them. Second, based on the literature review and the data collected from the interviews, the authors developed a quantitative questionnaire, which includes the main constructs of this research. The questionnaire was designed via Google Forms and distributed to auditors and managers working in the Big Four in Taiwan through social media. Furthermore, the questionnaire was also posted on a popular online accounting forum (PTT) in Taiwan to attract more audit practitioners. In order to increase the response rate, some small gift coupons were given away as incentives. More information regarding the cases, informants and the questionnaire is provided in the next sections.

![Conceptual model](image)

**Figure 2: Conceptual model**

Qualitative Interview Guide and Target Cases

The interview guide’s questions have covered several areas which mainly focus on the adoption, use, potentials, and challenges with BDA in the auditing sector. The first part of the interview guide investigated the use of data analytics or BDA in the target organizations. In addition, questions whether a timeline or strategy for adopting BDA exists was also asked. Also, the question whether the adoption of BDA is considered as a problem or challenge is also raised. The second part of the interview guide explored the interviewee’s understanding and knowledge about BDA. Questions about describing the characteristics of BDA and experiences of applying BDA at work or in the study were asked. Also, the interviewees were requested to share opinions about how BDA might impact their auditing work in the future, based on their knowledge and understanding of BDA. The third and fourth parts are concerned with the benefits and challenges that BDA might bring to the audit practices. The interviewer also described a short scenario derived from previous research where BDA can be applied and asked the interviewees to give comments. The last part of the question sums up the interview by asking what impact the interviewees thinks will occur and what the role of auditors in the future will look like?
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### Table 2: Overview of Target Cases & Informants

<table>
<thead>
<tr>
<th>Audit Firm</th>
<th>Job Title</th>
<th>Years of Experiences</th>
<th>Interview Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deloitte</td>
<td>Supervising Associate</td>
<td>Three</td>
<td>25 mins</td>
</tr>
<tr>
<td>KPMG</td>
<td>Senior Associate</td>
<td>Four</td>
<td>30 mins</td>
</tr>
<tr>
<td>PwC</td>
<td>Supervising Associate</td>
<td>Three</td>
<td>25 mins</td>
</tr>
</tbody>
</table>

### Quantitative Questionnaire

The questionnaire was designed by the authors via Google Forms and distributed to auditors and managers working in the Big Four in Taiwan through social media. Furthermore, the questionnaire was also posted on a popular online accounting forum (PTT) in Taiwan to ask other audit practitioners outside the social media circle. In order to increase the response rate, some small gift coupons were given away as incentives. Similar to the interview guide, the first part of the survey required the respondents to fill in their information, including which accounting firms they are or have been working in and the length of working experiences in audit profession. The second section involved understanding the current BDA applications within the accounting firms. The subsequent part of the questionnaire focused on getting audit practitioners’ understandings about BDA. The fourth section explored how BDA might be applied to audit cases. Next section dealt with the BDA barriers that the audit industry might face during the adoption period. The last section of the survey concentrated on understanding the impact BDA applications might bring to the audit practices and professions.

- **Sampling Strategy and Response Rate**

The auditing sector is huge in Taiwan and employs around 20,000 employees. Since most of the organizations are local and small auditing firms and are unable to initiate and establish BDA applications and projects into auditing, thus the targeted respondents were chosen from the Big Four. Moreover, in order to reach audit practitioners with the latest audit practices and experiences, a criterion requesting respondents to be auditors currently in service or have left less than a year was also established. The respondents should have at least some degree of auditing practice experiences and are curious about the future trends of auditing. The combined number of personnel associated with auditing in the Big Four is around four thousand (Financial Supervisory Commission, 2016). Taking a population size of four thousand with a confidence level of 95% and a margin error of 10%, the sample size calculator by SurveyMonkey gives out a recommended sample size of 95 respondents. Over the period of two weeks from 9th to 22nd of August 2017, the authors have received in total 112 responses, which exceeds the initial goal of 95 responses. Because the survey was designed that respondents have to answer all the required questions before submitting, all the responses received were completed and considered valid. As a result, the final sample size is 112. Among the 112 respondents, 21% of them are current or former employees of Ernst and Young, 25% of them are from KPMG, 40% of them are from Deloitte, and the rest 14% of them are from PricewaterhouseCoopers. As for the length of the audit working experiences, 70% of the respondents are between one to three years, 27% of them are between four to six years, none of them are between seven to ten years and 3% of them are over ten years. The result indicates that respondents are mostly entry-level or junior supervisors, who are regarded as front-line practitioners.

### Findings and Discussion

Concerning the direction of audit procedures in the future, KPMG has begun to recruit talents with information and computer science backgrounds. An interviewee from Deloitte mentioned that “the amount of work on adopting data analytics on internal control examination will grow, while substantive testing will be reduced. Now it is about 70 to 30; it will be 20:80 very soon.” Meanwhile, PwC established a department specifically for data analytics purposes, which aids in assisting traditional audit teams with tasks that are beyond their capacity. Those are the signs that audit firms in Taiwan are gradually turning toward data analytics to help with audit practices. While data analytics has become more and more common, big data, however, is still not a concept that can be related to auditing. “We talk about AI, we talk about Machine Learning and how might auditor get replaced by machines, but big data is never the subject.” (Interviewee from PwC). The largest obstacle is about the cost of implementing big data into auditing. “Audit firms need to spend time and money constructing data control system, upgrading computer hardware, and training skilled employees, is it worth the investment? The clients of audit firms might not see the value of applying BDA and will refuse to pay more audit fee.” (Interviewee from KPMG). The future audit work and the role of auditors will be changed and become more technical and data analytics related. “Auditors have to have data analytics ability,
and those skills need to be cultivated from courses in university” (Interviewee from KPMG). Furthermore, audit work will require a considerable amount of time on communicating with clients and making sure that the data sources are reliable and pure. Mutual understanding and constant communication with the clients will be crucial to the success of audit practices. An interviewee from PwC proposes that audit firms need to collaborate with governments and external organizations to build a comprehensive “Data Network,” where data can be shared and supervised by every member. “Data can either be a weapon or a shield, depending on how we wield it” (Interviewee from PwC). What data are auditors allowed to obtain? Who takes the responsibility if the data is corrupt? How should the data be collected and shared? Those are the main issues that audit industry must face when adopting BDA into auditing.

**Findings from the quantitative study**

- **Uses of Data Analytics and BDA in Auditing**

<table>
<thead>
<tr>
<th>Accounting Firm</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total Respondent</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ernst &amp; Young</td>
<td>1</td>
<td>8</td>
<td>14</td>
<td>23</td>
<td></td>
<td></td>
<td>4.57</td>
<td>0.59</td>
</tr>
<tr>
<td>KPMG</td>
<td>1</td>
<td>5</td>
<td>15</td>
<td>7</td>
<td>28</td>
<td></td>
<td>3.96</td>
<td>0.88</td>
</tr>
<tr>
<td>Deloitte</td>
<td>1</td>
<td>8</td>
<td>26</td>
<td>10</td>
<td>45</td>
<td></td>
<td>4.00</td>
<td>0.71</td>
</tr>
<tr>
<td>PricewaterhouseCoopers</td>
<td>1</td>
<td>10</td>
<td>5</td>
<td>16</td>
<td></td>
<td></td>
<td>4.25</td>
<td>0.58</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>15</td>
<td>59</td>
<td>36</td>
<td>112</td>
<td></td>
<td>4.14</td>
<td>0.75</td>
</tr>
</tbody>
</table>

**Figure 3:** Is your audit firm applying data analytics into auditing?

Among the 112 respondents, 85% of them have at least some degree of agreement that their audit firms incorporate data analytics into auditing, meaning that data analytics is not a new gadget to auditors and has gradually become a part of standard audit procedures.

<table>
<thead>
<tr>
<th>Accounting Firm</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total Respondent</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ernst &amp; Young</td>
<td>1</td>
<td>6</td>
<td>16</td>
<td>23</td>
<td></td>
<td></td>
<td>4.65</td>
<td>0.57</td>
</tr>
<tr>
<td>KPMG</td>
<td>1</td>
<td>2</td>
<td>11</td>
<td>8</td>
<td>28</td>
<td></td>
<td>3.82</td>
<td>1.06</td>
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<td>Deloitte</td>
<td>1</td>
<td>3</td>
<td>13</td>
<td>13</td>
<td>45</td>
<td></td>
<td>3.96</td>
<td>0.95</td>
</tr>
<tr>
<td>PricewaterhouseCoopers</td>
<td>1</td>
<td>5</td>
<td>8</td>
<td>2</td>
<td>16</td>
<td></td>
<td>3.69</td>
<td>0.79</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>6</td>
<td>47</td>
<td>39</td>
<td>112</td>
<td></td>
<td>4.03</td>
<td>0.94</td>
</tr>
</tbody>
</table>

**Figure 4:** Does your firm have clear plans to adopt more data analytics in the future?

The result of Question 2 reveals that 77% of the auditors agree that their audit firms are planning to adopt more data analytics into audit practices in the future.

<table>
<thead>
<tr>
<th>Accounting Firm</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total Respondent</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ernst &amp; Young</td>
<td>2</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>23</td>
<td>3.04</td>
<td>1.19</td>
</tr>
<tr>
<td>KPMG</td>
<td>1</td>
<td>8</td>
<td>14</td>
<td>4</td>
<td>1</td>
<td>28</td>
<td>2.86</td>
<td>0.85</td>
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<tr>
<td>Deloitte</td>
<td>4</td>
<td>11</td>
<td>16</td>
<td>11</td>
<td>3</td>
<td>45</td>
<td>2.96</td>
<td>1.07</td>
</tr>
<tr>
<td>PricewaterhouseCoopers</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>16</td>
<td>3.25</td>
<td>1.18</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>28</td>
<td>43</td>
<td>33</td>
<td>10</td>
<td>112</td>
<td>2.99</td>
<td>1.05</td>
</tr>
</tbody>
</table>

**Figure 5:** Is your firm applying BDA into auditing?

Compared with the result of applying data analytics, the average score of applying BDA into auditing is noticeably lower, with less than 30% of the respondents answering that their firms are using BDA into auditing, which corresponds to the outcomes of the semi-structured interviews that most audit firms have not yet adopted BDA into auditing. When asked about the future adoption of BDA into auditing, circa 50% of the respondents indicated that there are clear intentions or guidelines to adopt more BDA in the future in their audit firms. While the scores are divergent across all Big Four, the result also reveals that a significant difference might exist internally even within an individual audit firm. Different industry and client might require different auditing techniques and focus area, which can explain the various opinions left by auditors.
• Understandings of Big Data analytics

Figure 6: Characteristics that are related to BDA

Figure 6 presents the average scores of the eight characteristics based on respondents’ knowledge and understandings. The first three traits are derived from the 3Vs that are considered as the fundamentals of BDA. Not surprisingly, “Volume” is recognized and understood by more than 92% of the auditors and receive the highest score. However, the other two Vs: Variety and Velocity are less well-known with 78% and 74% of respondents understood respectively. The rationale might be that auditors are accustomed to financial (structured) data, which is usually prepared by clients periodically. So, auditors do not have chances and the skills to interact and deal with data that is unstructured and automated.

Figure 7 below, presents the result of what auditors think could be the concerns of applying BDA. The list of issues was based on our literature research and the outcomes of the interviews.

Figure 7: Challenges and concerns related to BDA

• Potential BDA Applications in Auditing- Scenarios

In this section, three audit cases applying BDA are presented, and respondents were asked to rate according to the level of agreement.

Occurrence of a transaction

To ensure the occurrence of a transaction is achieved and the goods have been shipped, aside from getting shipment document and invoices, GPS record of the transportation route and video footage of the process can be used as supporting audit evidence.

<table>
<thead>
<tr>
<th>Issues</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total</th>
<th>Average</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility</td>
<td>10</td>
<td>24</td>
<td>22</td>
<td>33</td>
<td>23</td>
<td>112</td>
<td>3.31</td>
<td>1.27</td>
</tr>
<tr>
<td>Reliability of the data sources</td>
<td>3</td>
<td>13</td>
<td>21</td>
<td>47</td>
<td>28</td>
<td>112</td>
<td>3.75</td>
<td>1.04</td>
</tr>
<tr>
<td>Client’s willingness when giving data to auditor</td>
<td>23</td>
<td>40</td>
<td>19</td>
<td>18</td>
<td>12</td>
<td>112</td>
<td>2.61</td>
<td>1.28</td>
</tr>
<tr>
<td>Client’s acceptance on the results</td>
<td>7</td>
<td>18</td>
<td>42</td>
<td>30</td>
<td>15</td>
<td>112</td>
<td>3.25</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Figure 8: Occurrence of a transaction

What is worth mentioning is the fact that auditors’ opinions are quite divergent regarding feasibility. When divided into two groups, the group which rates 1 or 2 for feasibility has an average score of 1.5 for client’s willingness, while
another group which rates 4 or 5 for feasibility has an average score of 3.3 for client’s willingness. This phenomenon suggests that the client’s cooperation with auditors plays crucial role in the success of this BDA usage in auditing.

**Bad debt estimation**

Currently, bad debt estimation is mostly done by subjective judgement. Under Big Data analytics, texts from email with clients can be used as the sources to decide the possibility of bad debt occurrence. The vocabulary, the sentences or the tone of the email will be analyzed to examine whether our clients will pay back their payable.

<table>
<thead>
<tr>
<th>Issues</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total</th>
<th>Average</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility</td>
<td>19</td>
<td>34</td>
<td>26</td>
<td>18</td>
<td>15</td>
<td>112</td>
<td>2.79</td>
<td>1.28</td>
</tr>
<tr>
<td>Reliability of the data sources</td>
<td>16</td>
<td>25</td>
<td>29</td>
<td>31</td>
<td>11</td>
<td>112</td>
<td>2.96</td>
<td>1.21</td>
</tr>
<tr>
<td>Client’s willingness when giving data to auditor</td>
<td>30</td>
<td>29</td>
<td>26</td>
<td>17</td>
<td>10</td>
<td>112</td>
<td>2.54</td>
<td>1.28</td>
</tr>
<tr>
<td>Client’s acceptance on the results</td>
<td>21</td>
<td>30</td>
<td>39</td>
<td>16</td>
<td>6</td>
<td>112</td>
<td>2.61</td>
<td>1.11</td>
</tr>
</tbody>
</table>

**Figure 9: Bad debt estimation**

The result might indicate that using text analysis to assist decision making still receives low recognition and trustworthiness not only among auditors but also clients. Clients will have low tendency to give out data and not likely to be convinced based on the outcome of text analysis.

**Lower of cost or market testing of inventory**

When doing lower of cost or market testing for inventory, data from various external sources, like news coverage, feedback from social media or macroeconomic index can be used as independent parameters to assess inventory value.

<table>
<thead>
<tr>
<th>Issues</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total</th>
<th>Average</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility</td>
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<td>6</td>
<td>26</td>
<td>57</td>
<td>20</td>
<td>112</td>
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<td>0.90</td>
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<td>14</td>
<td>32</td>
<td>50</td>
<td>12</td>
<td>112</td>
<td>3.46</td>
<td>0.97</td>
</tr>
<tr>
<td>Client’s acceptance on the results</td>
<td>10</td>
<td>18</td>
<td>33</td>
<td>43</td>
<td>8</td>
<td>112</td>
<td>3.19</td>
<td>1.08</td>
</tr>
</tbody>
</table>

**Figure 10: LCM Testing for inventory**

The third BDA application scenario was to make judgments about inventory value using LCM method (lower of cost or market). To do LCM testing, common audit practices include inspecting the latest prices the product was sold at or searching for the prices of similar items in the market.

**Adoption Barriers of BDA application in auditing**

From the outcomes of the survey, it can be seen that the top three barriers chosen by the auditors are “Client may be reluctant to give auditors confidential business data,” “Cost-benefit uncertainty” and “Lack of employees with data-analytics skills and expertise”. The first response corresponds to the result from previous part of the survey in which most auditors give the lowest scores on client’s willingness to provide data access to auditors.

**Figure 11: Adoption Barriers of BDA application in auditing**
Applications of Big Data Analytics in Financial Auditing

Impact on Audit Practices and Auditor

The rise of auditing committees has, on a large extent, been evolved through the innovations and the implications of UK and US. The two countries vary in their functions but have several similarities in the role of auditing committees. In the contemporary scenario, the role of auditors in finance market is more crucial than before. Their purpose is to serve the public with best quality on a regular basis and deliver several perceptions of value to the financial statements’ stakeholders. The primary driver of BDA applications by auditors is based on the demands of clients (Alles, 2015). There are no bounds for the application of BDA in auditing firms as its actual amalgamation is not derived. It may vary from the requirements of each client and the concerned firm.

- Impact on audit practices

BDA application can not only assist auditors during the audit process but also before an audit case. With the help from BDA, auditors can assign the resources and evaluate the working hours needed more accurately. Thus, the respondents were asked about their opinion or if they agree with two statements. The first descriptive statement was based on the concept of assisting decision making from the literature. The statement was “Applying BDA into auditing can potentially enable auditors to identify high-risk areas or anomalies in data, thus BDA can be used to reduce the risk of audit failure and assign the right personnel to the task”. Nearly 90% of the auditors are in favor of this description, indicating that most auditors agree with that BDA can be applied in other stages besides actual audit procedures. The second statement presented to the respondents, was about the introduction of auditing in current audit practices. Because of the characteristics of data analytics, the audit practices as we know today will become more data-driven, and the responsibility of auditors will also be transformed to ensure that anomalies will be identified and handled in real-time. Instead of taking on a passive role, auditors will actively and continuously monitor the data processing procedures to make sure that every step follows the protocols. Thus, the participants were asked about their opinion on the following statement, “Audit work will become more data-analytics intensive. To address the increasing amount of data, continuous auditing will be mainstream, where audit practices are conducted in real-time. Auditors will proactively detect and investigate anomalies as they occur”. The results show that the majority (91%) of the auditors agree with the statement and that the audit practices will most likely become mainstream in the future from their perspective.

- Impact on auditors

The last part of the survey was set to discover the skills auditors need to have in an era of big data. Figure 14 reveals the average scores for each of the skill. The skill that has the highest score is the ability to perform data analytics skills. From the previous part of this study, it can be learned that audit firms have begun to adopt data analytics as a mean to perform audit practice and plan to expand the use of it in the future.

Conclusion:

While our main findings suggest that ca. 85% of the respondents have experiences in incorporating traditional data analytics into auditing, however less than 30% of them have used big data analytics in auditing. On the other hand, around 80% and 50% of the auditors indicated that there is a clear guideline in their audit firms to adopt more data analytics and BDA in the future, suggesting that there is a huge potential for BDA application ahead. In terms of the understanding of BDA, auditors are more comfortable with the concepts and analysis techniques that are similar to audit procedures, such as volume of datasets, descriptive analytics, and data mining. What auditors consider as the
most critical factor of BDA applications is the collaboration with clients. From the results of the questionnaire, it can be seen that auditors put more attention on clients’ willingness to give out business data than technical feasibility. The top three obstacles identified by the auditors were “client may be reluctant to give auditors confidential business data,” “cost-benefit uncertainty” and finally “lack of employees with data-analytics skills and expertise.” As far as the impact on audit practices and auditors is concerned, the outcomes of the survey reveal that BDA will most likely be incorporated into different phases of the audit practices, according to nearly 90% of the respondents. Moreover, real-time auditing will most likely become mainstream in the near future. Incorporating BDA into auditing still faces numerous barriers and hurdles, which might be the reasons why some respondents left comments about auditors not being interested in BDA and that it is pointless to take on extra work and adopt new techniques. However, the audit industry has encountered a bottleneck in recent years, and the field has stagnated. Audit firms compete with each other on price, rather than innovation and novelty, leading to a phenomenon that clients tend to find the less-expensive audit firms to finish the job.

References:


