

## **BIG DATA AND BIG DATA ANALYTICS IN EXTERNAL AUDITING: MOTIVATIONS AND CHALLENGES**

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### Abstract

*Big Data (BD) and Big Data Analytics (BDA) has become an increasing trend all over the world and has gained popularity across various sectors; areas of accounting and auditing are not an exception. Even though there are benefits and optimistic views from experts to the use of BD and BDA in External Auditing (EA), application in real circumstances results in challenges. Therefore, the objective of this study is to examine the motivations and challenges of using BD and BDA in the Sri Lankan EA context. This paper is significant in terms of its objectives of both motivators and inhibitors for the use of BD and its research context of Sri Lanka which is a developing country. The study used a qualitative methodology by employing a general qualitative inquiry approach with the use of multi-perspectival analysis of Big 4 audit firms in Sri Lanka, Audit client companies, respective Regulators, and Professionals for data analytics in Sri Lanka. As per findings, it was evident that the Sri Lankan external auditing industry is still at the start of adopting innovative technologies and changing fast with expanding the usage of innovative tools mainly driven by both internal and external pressures. Using BD to EA is coming from both the demand and supply sides. The most challenging factor for using BDA is the lack of knowledge on BD and BDA of external auditors. The study emphasized the need for audit companies to implement BD driven approach by overcoming the challenges faced and customizing the audit strategy to gain long-term efficiency in the external auditing industry of Sri Lanka.*

Keywords: big data, data analytics, external auditing, new institutional sociology

### **1. Introduction**

With the advancement of technology in the current information age, exciting and new world of possibilities are enabled in various fields. One of the major trends across the globe is incorporating big data (BD) and big data analytics (BDA), from macro level to the micro level, to be innovative, effective, and competitive. Companies that can effectively utilize BD, gain a 5 to 6 percent higher gain in productivity on average (Bynjolfsson, Hammerbacher, & Stevens, 2011). This fact is not getting unnoticed

by the auditors' community and thus, they have started implementing BDA in their operations.

As auditing practice completely deal with vast amount of information it is one of the major fields which is getting affected from this new trend of BD and BDA. The effect is heightened with the use of BD as an essential business tool by audit clients and has lead the auditors to do “*auditing through big data*” (Alles, 2015, p. 4). Progressively, by using BD in external auditing (EA), it revolutionizes the way that audits are conducted.

Considering the empirical evidence, audit firms have had a mixed history of implementing assurance-related technologies. Earlier, researchers have shown their optimistic views on Artificial Intelligence, Expert systems, Data mining and Continuous auditing as the technological tools for financial statement audits. Alles and Gray (2016) points that, at that time, the (then) big six audit firms were spending millions of dollars for developing expert system applications. However, according to Gray, Chiu, Liu and Li (2014) none of these stand-alone applications were incorporated into regular financial statements auditing activities. Despite the benefits and optimistic views from experts, the application of technology related tools in EA in real circumstances faced challenges/ inhibitors/ issues.

The use of BD and BDA in EA results various benefits such as ensuring audit quality by improving the efficiency and effectiveness of financial statements audits, providing robust picture on audit clients' activities and client business risk, analyzing all or almost all the client transactions rather than a sample and the ability to discover the patterns easily. Through that BD and BDA improve the predictive power of future occurrence which can easily assess fraud risk, internal controls and going concern.

Moreover, Alles and Gray (2016) states that use of BD and BDA would be a paradigm shift as to how financial statement audits are conducted. Therefore, challenges are there while applying it in practice. Therefore, it is evident that there is both motivation and challenge the use of BD and BDA in EA practice for external auditors. Notably, even though there are benefits and

optimistic views from experts, application in real circumstances results challenges for technology related tools in EA.

Currently, the researchers had started noting the importance of considering how the field of auditing embrace BD and BDA for EA (Alles, 2015; Janvrin & Watson 2017) and on motivations and challenges for the use of BD and BDA in EA. However, research on understanding the motivations and challenges to use BD and BDA in EA is limited in other countries as well as in Sri Lanka and there is a lack of understanding on motivations and challenges of using BD and BDA in EA. Specifically, in the Sri Lankan context (which is a developing nation) it is a puzzle, which has not been clearly resolved in past literature. This study addresses this gap and contribute to the Auditing field in three ways by answering its three research questions: (1) why external auditors currently use/not use BD and BDA in EA?; (2) How have the external auditors motivated and challenged in using BD and BDA for EA?; and (3) How to overcome the challenges in using BD and BDA for EA?. In answering the three research questions following are the research objectives of the study, (1) identify the reasons for the current use/non-use of BD and BDA in EA; (2) explain the perceptions of practitioners on motivations (benefits) and challenges for using BD and BDA in EA using the NIS perspective; and (3) attempt to summarize the practitioners' views on how auditors can overcome the challenges in using BD and BDA in EA.

## **2. Literature review**

The literature review focuses the extant literature around BD, BDA, and EA concepts. Firstly, evolution and adoption of BD and BDA to EA, opportunities, and criticisms of using BD and BDA in EA is discussed. Thereafter, new institutional theory and link between adoptions of BD into EA is presented.

### ***2.1. Evolution of EA with the use of technologies***

The propensity to invest in technologies is not new among audit firms. For instance, investments made on statistical sampling is an innovative technology that provided scientific rationality in determining audit samples (Carpenter & Dirsmith, 1993). Literally, this tendency of investing in technological innovations is arisen to par with the audit clients. In the last few years, the term BD has emerged as the new buzz word (Janvri & Watson, 2017). Moreover, the technology of BD and BDA has gained popularity across various sectors, ranging from government and various business sectors to education and research fields (Simplilearn, 2020) and to the area of accounting and auditing (Dagiliene & Kloviene, 2019).

BD can be defined as a massive volume of both structured and unstructured data that is so large, complex and difficult in nature to capture, manage and process using traditional database and software techniques (Demchenko, Grosso, Laa, & Membrey, 2013). Accordingly, Brown-Liburd and Vasarhelyi (2015) states that BD will pose the measurement of business (*accounting*) and the assurance of this measurement (*auditing*) for new possibilities as well as threats. And also makes this point that auditing becomes a

challenging task for auditors to analyze the complex accounting transactions.

Moreover, with the advancement of technology, audit clients increasingly rely on BD (Alles & Gray, 2016; Janvir & Watson, 2017). Accordingly, BD and BDA become an essential business tool of audit clients and increasingly become equally essential part of assurance practice for auditors to do “*auditing through big data*” (Alles, 2015, p. 4). Correspondingly, Alles, Kogan and Vasarhelyi (2002) made the argument that using BD to EA is a demand rather than a supply-side decision. In other words, the imperative to keep up with their clients’ reliance on BD is the exogenous driver that will force auditors to also adopt BD. Besides, the profession’s reaction to BD, it will strengthen auditors to maintain their credibility with their clients who see BD as a strategic driver of their business (Alles, 2015). Furthermore, EA is an area which is highly constrained by the standards. Auditing standards capture the big picture of what constitutes audit evidence, and they are not written in a way that constrains the use of any source of data (Rezaee, Dorestani, & Aliabadi, 2017). While standards do not seem to drive barriers to the adoption of BD and BDA (for now), the use of non-traditional data brings issues.

### ***2.2. Opportunities and criticisms of using BD and BDA in EA***

Literature provides evidence that the use of BD carries new opportunities to the field of EA. It is evident that the use of BD and BDA is useful and valuable for ensuring audit quality by improving the efficiency and effectiveness of financial statements audits by using BD as an audit

evidence (Cao, Chychyla, & Stewart, 2015; Brown-Liburd, Issa & Lombardi, 2015; Yoon, Hoogduin, & Zhang, 2015; Dubey & Gunasekaran, 2015). It is evident that, in this information age BD and BDA provides robust picture on audit clients' activities and client business risk at the planning stage (Alles & Gray, 2016; Brown-Liburd et al., 2015). Furthermore, KPMG (2014) states that BD and BDA enable to analyze all or almost all the client transactions rather than a sample and able to discover the patterns (Alles, 2015; Alles & Gray, 2016). Through that BD and BDA improve the predictive power of future occurrence which can easily assess fraud risk, internal controls and going concern (Brown-Liburd et al., 2015; Yoon et al., 2015). After receiving harsh criticism under the Enron and WorldCom' scandals and the financial crisis, auditors feel some pressure to adopt BD and BDA to ensure additional credibility about their work (Alles, 2015).

Moreover, Alles and Gray (2016) states that use of BD and BDA would be a paradigm shift as to how financial statement audits are conducted and Dubey and Gunasekaran (2015) emphasized that it is challenging to have additional competencies (soft skills) and technological capabilities (hard skills) that are necessary to implement BDA in auditing practice. The degree to which these tools can be applied depends on the stage of the audit. For example, planning and risk assessment phases easily tolerate the use of unstructured data, but substantive procedures are more sensitive to the organization of data. New guidance and education on audit field linked to automated systems is required since the integration of BD demands a greater skill set (Cao

et al., 2015). By adding more for the above emphasis, Alles and Gray (2016); Alles (2015); and Cao et al. (2015) states that implementing BDA in auditing practice is costly because it requires new guidance, education and trained personnel to the audit firms. Further, doubts on relevancy and trustworthiness of data gathered as BD (Brown-Liburd et al., 2015); possibility of reduced data quality because of false positives (Yoon et al., 2015); the need of third-party guidance on BDA implementation for audit firms that create challenging privacy concerns (Cao et al., 2015); and the complexity in data aggregation when using BD and BDA due to data incompatibility, as generated through several sources (Santos, 2019) were other issues.

Overall, the use of BD and BDA in EA is both motivating and challenging task for external auditors and auditors are lagging the use of non-traditional data such as BD, to support their work. At the same time, the lack of guidance from Audit standards could be an obstacle to the use of BD in auditing in the future (Alles, 2015).

### ***2.3. New Institutional Sociology (NIS) and its Link to the Adoption of BD in EA***

Many past studies on adoption of new strategy/technology to firms have used NIS as a theoretical lens (Jalaludin, Sulaiman, & Ahmad, 2011; Molinillo & Japutra, 2017; Holotiuk & Moormann, 2018; Hofer, Hofer, Eroglu & Waller, 2011) and Hussain and Hoque (2002) suggests the use of NIS for understanding organizational phenomena. Bozan, Davey, and Parker (2015) found institutional characteristics show strong influence on adoption of technology to institution. Other audit related studies used NIS to understand

change in technology as an institutional change (Curtis & Turley, 2007; Robson, Humphrey, Khalifa & Jones, 2007), in which both the auditors and technology reshape the market for audits and audit practices.

The survival of audit firms depends on their conformity to the expected standard of behavior. With the existence of many actors in the field, firms actively engage in activities that are socially acceptable and desirable. However, bringing BDA into the audit field as a way of conducting an audit is not straightforward; audit firms must convince the relevant stakeholders that BDA is socially desirable and appropriate in meeting the demands of external audits. Therefore, audit firms must make sure that BDA acquires legitimacy from the relevant stakeholders, such as clients, regulators, and standard setters. Specifically, NIS provides a rich and complex view of the isomorphic behavior of organizations and suggests that organizations are influenced by varied institutional pressures in their external environment (Munir & Baird, 2016). According to DiMaggio and Powell (1983) once a set of organizations emerges as a field and a paradox arises: rational actors make their organizations increasingly similar while changing them and it described using three isomorphic pressures namely coercive, mimetic, and normative. In this sense, NIS attempts to provide theoretical constructs for understanding the adoption of BD and BDA to the field of auditing.

### **3. Research methodology**

Given the nature of the research questions of the study (i.e., Why external auditors currently

use/not use BD and BDA in EA: How have the external auditors motivated and challenged in using BD and BDA for EA; and How to overcome the challenges in using BD and BDA for EA?), it followed Yin (2003) and used a qualitative approach. Further, with the limited adoption of BD and BDA in EA in Sri Lanka and the limited knowledge of auditors on this area, it was considered not useful to explore a case organization (e.g., an audit firm) as a case study as it may inhibit the value of the findings.

As none of the five types of qualitative studies (i.e., case study, phenomenology, narrative inquiry, ethnography, and grounded theory) fit neatly to this study, a general qualitative study was used (Creswell, 2013) which gives the flexibility of designing the study to meet the aims of the study. Further, as this study is exploratory in nature employing general qualitative approach with the use of multi-perspectival analysis is used as the methodology.

To ensure the richness of the study, all the participants of EA i.e., the external auditors and data analyst in the “Big Four” audit firms in Sri Lanka, data analysts in business organizations, and standard setters (regulatory bodies) were taken as informants in the research context. Primary data was collected through interviews using a two separate semi-structured interview guides. Being a new practice the knowledge and use of BD and BDA was limited; thus, semi-structured interviews best suited for data collection. Initial interviews were conducted with external auditors of the Big 4 audit companies because they are responsible for doing financial statement audits practically. With the evidenced lack of external auditors’ theoretical and practical

knowledge on BD technology, the researchers decided to extend the interviews to IT staff (mainly, data analysts) in Big 4 audit firms. In addition, three data analysts at three business organizations and two professionals in regulatory body related to the EA were interviewed. Finally,

an interview was conducted with a senior lecturer at a state university related to Information Technology and Management to further verify the data collected. Details of interviewees is provided in Table 1.

Table 1. Interviewee details

Organization	Designation of the interviewee	Duration	Code
Big 04(1) audit firm	1. Assistant Manager	45 minutes	Respondent 1
	2. Senior Manager- Data Analytics	40 minutes	Respondent 2
Big 04(2) audit firm	3. Project Manager	60 minutes	Respondent 3
	4. Information System Analyst	20 minutes	Respondent 4
Big 04(3) audit firm	5. Audit Associate	40 minutes	Respondent 5
	6. Senior Manager- Data Analytics	30 minutes	Respondent 6
Big 04(4) audit firm	7. Assistant Manager	30 minutes	Respondent 7
	8. Audit Associate	45 minutes	Respondent 8
<b>Business Clients</b>			
1. Retail Supermarket Chain	9. Senior Manager- IT	50 minutes	Respondent 9
2. Telecommunication Company	10. Information System Engineer	30 minutes	Respondent 10
3. Information Technology Service Company	11. Software Engineer	35 minutes	Respondent 11
<b>Regulatory Body</b>	12. Manager- Technical	20 minutes	Respondent 12
	13. Technical Consultant	20 minutes	Respondent 13
<b>Government University</b>	14. Senior Lecturer- Faculty of Information Technology and Management	1 hours and 15 minutes	Respondent 14

#### **4. Data presentation and analysis**

This section illustrates the findings of the current study. First, the current use of BD and BDA in the Sri Lankan EA industry is discussed; next, the motivations and challenges faced by external auditors are presented and finally the methods that can be used to overcome challenges are presented. The motivation is theorized in accordance with the three isomorphic pressures in NIS.

##### ***4.1. BD and BDA: current practice within the EA industry***

BDA in EA is changing the way financial statement audits are carried out and interest has grown in suggesting a profound change in the audit field which is facilitated by BDA. However, this change is not happening in a vacuum because the audit field is very complex and interconnected with stakeholders of assurance engagements. Following sections describe the current practices related to BD and BDA of stakeholders of EA and the reasons behind the use.

##### ***4.1.1. Audit companies***

All respondents stated that the adoption of BD and BDA in financial statement audits is at a very early stage of development. As per the respondents, the application of such innovative data analytic methods for EA is still lagging in Sri Lanka compared to developed countries, mainly because Sri Lanka is not taking the initialization of implementing advanced technologies. However, it is evident that international audit companies have taken the first steps towards adoption of BD and BDA into their operations worldwide (Deloitte, 2013; PWC 2018; KPMG 2018; EY, 2015) and that they are gradually

introducing them to their global operations (including Sri Lankan offices). Accordingly, an expansion of the usage of analytical tools are notable. It was confirmed with the comments made by the Respondent 1 on their company specific data analytics tools.

*“Due to the competition at the EA industry, we have to change with the technology to give a better service for our clients. Therefore, we implemented new and advanced analytical tools which are created and developed in headquarters of our company. And most of the time Big 04(1) at Maldives which is the regional head of ours informs us regarding the new practices, strategies.”*

According to the explanation made above, some Sri Lankan audit firms are currently using advanced analytical tools which are provided by their parent company and they follow the instructions rather than developing the use on their own. Thus, the Big 4 audit firms in Sri Lanka develop and apply advanced analytical tools that are content-wise and complexity-wise similar to BDA which are created by their global network. However, when deeply analyzing the meaning of BD and BDA, those analytic tools currently used by these organizations cannot be considered as actual BDA. Further, as evident during the interviews, there is a gap between theoretical definitions of BD and BDA and perception of auditors on BD and BDA. The Respondent 6 mentioned that,

*“when you talk about BD in financial terms, that is, in audit context, it is about managing all the journal entries. But in our capacity, the real use of BD and BDA cannot be taken.*

*Because, collecting information outside the company is almost impossible.”*

Therefore, a differentiation and a clarification on these terms are required in contexts that are newly adopting these phenomena.

Sri Lankan audit companies are yet to use real BD and BDA for their normal audit procedures. However, as per respondents it was identified that, for specially identified clients, BDA is used because there is no other way to analyze the data sets of those clients. Respondent 02 stated that,

*“Mostly for the digital entities such as entities using e-commerce, we cannot apply the same standard auditing procedures which we use for the other clients. In auditing, we are relying on the samples but for these fully digitalized entities it is very difficult to pick a sample because each record of the business is in digitized form. Therefore, we must go for some innovative methods to check their records and BDA is one such innovative method that we use to analyze the records of those clients.”*

Further, as per the above response (“to check their records”), it is evident that even for these special clients, BDA is applied only for analyzing their structured data (financial data). In Sri Lanka, the use is still at the initial stage and the use of real BD and BDA in EA is yet to be developed.

As per collected data, the external auditors are not sufficiently capable of analyzing the data sets of those special clients and thus, support of data analysts in the audit companies are necessary to express an opinion regarding the financial statements. Respondent 03 mentioned that,

*“if we cannot do the analysis or if the systems are more sophisticated, we take help from the*

*‘Information Risk Management’ section in the firm; and they do the analysis and provide relevant information. They are doing data analysis using BDA on behalf on us. They are experts in IT plus accounting. Actually, they are professionals in both IT and accounting.”*

This lack of capability of auditors in handling the innovative technological developments such as BD and BDA, when compared to the data analysts, lead to “not use” or “less use” of BDA in EA. As mentioned by Dubey and Gunasekaran (2015) additional competencies (soft skills) and technological capabilities (hard skills) are necessary to implement BDA within the audit practice.

#### **4.1.2. Business clients**

Many business client companies (who are usually referred as - audit clients) already use BD and BDA tools for internal purposes and to manage business processes and make decisions. With the benefits realized by using it, most of them intend to expand the use in future. Further, BD and BDA have become important for surviving with the high competition in the business world and obtaining competitive advantage is one of the main drivers for the use of BD and BDA by them. Respondents emphasized that BD and BDA are not new for the business organizations in Sri Lanka compared to the EA industry.

Further, it was evident from responses that, there is a clear difference regarding the use of BD and BDA by audit companies and business clients in their operations. In the EA industry in Sri Lanka, the use is still at the initial stages compared to their audit clients (business companies).



#### **4.1.3. Regulatory and professional bodies**

Regulatory bodies and professionals understand the importance of BD and BDA tools as an increasing trend for all sectors including business companies and audit companies. So far, BDA is not considered or proposed as an auditing tool for EA in their standards or guidelines. They do not have much experience in this area; but they have some understanding on the power of data analytics and BDA (as stated by Respondent 11) and are aware on the usefulness of it to the EA procedures. Despite the knowledge and understanding on its use, overall, the regulators in Sri Lanka presented a neutral attitude towards the incorporating BD and BDA tools to EA. This impliedly mean that standards do not seem to be a barrier to the use BD and BDA.

#### **4.2. Motivations to use BD in EA**

Currently, in the Sri Lankan EA industry there is no considerable use of BD and BDA. When considering the motivation for the use of BD and BDA in EA, as per the Respondent 14, BD and BDA tools can be considered as a “Facilitator” for decision making to accountants and auditors. Having BD and BDA used for auditing may enhance the power of decision making as it will act as a “powerful facilitator” for decision making. In addition, the motivations to use BD and BDA were clearly described by the data analysts and IT specialists in audit companies and by business clients [however, it was noted that the information provided by the external auditors were comparatively less. In fact, limited adoption of BD and BDA is the reason for their lack of knowledge. However, external auditors are

knowledgeable up to some extent on the advantages of BDA].

Most respondents stated that EA procedures no longer need to depend on sample testing; instead, they can rely on 100% sample analysis which can improve the quality of analysis which is one other motivation for the use. As Respondent 02 stated:

*“... my involvement to external auditing is to replace the manual sample basis system of checking the records which is used to be done by the auditors. So, I replaced it with completely digitalized system to give a comfort to the audit team. I can explain you about the role of a data analyst using some scenario. First, I identify the business logic of our clients. It means what kind of a business it is, their business segments and what are the revenues of them. Then I gather all the records that they have on their business activities, and normally it has billions of records. Secondly, I crunch all data systematically and then analyze and formulate some formulas using ‘R’ which is a BDA tool. Finally, I independently calculate the revenue and it will be matched with the revenue gathered by the business itself. So, it helps our audit team to verify the amount of revenue and to figure out any discrepancies.”*

Such statements of respondents necessarily imply a paradigm shift in the way audit processes are conducted and shift in the way how data is being used. The common practice of using data samples could be replaced by analyzing full populations. It emphasized that the task of risk assessment, substantive procedures and test of controls may be different when 100 percent of

data are examined (Yoon et al., 2015). Following this rationale, auditors may shift from an audit engagement from sample driven to population-driven for obtaining more efficient audit evidence than before.

BD and BDA methods are an opportunity to improve quality and efficiency of the financial statement audits through less human involvement. Traditionally, auditors analyze the collected data manually, using excel. However, common issues such as occurrence of mistakes due to human nature and influence of subjectivity may arise when analyzing data manually. By incorporating BDA to EA all such issues can be avoided, and quality of audits can be enhanced.

Moreover, the largest (Big 4) audit companies in Sri Lanka considered the BD and BDA as a competitive advantage in the audit market; auditors can focus on drawing better conclusions and adding value to their clients by providing better recommendations to comply with new standards. At the same time, to be compatible with the changes in market conditions, auditing standards are getting revised time to time. For instance, recently, 'Sri Lanka Financial Reporting Standard 9- Financial Instrument' largely replaced the previous standard of LKAS 39- Financial Instrument, due to the change in market conditions. As stated by the respondent 05 these changes also positively motivate auditors to use BD and BDA in EA. He further stated the following facts related to the Sri Lanka Accounting and Auditing Standards:

*"I think, the best and easy way to comply with the new standards is this BDA. Because most of the new standards are focused on data analysis. Without doing the data analysis, we*

*cannot comply with new standards like SLFRS-9. So, I think Big 04(3) use BDA to be more professional by align to auditing standards. 'Building trust in society and solving important problems' is the business strategy of Big 04(3) globally. So, we work to deliver quality service to society. In Sri Lanka, Big 04(3) is the firm that used this technology effectively for external auditing. I think other audit firms are following us."*

Use of BD technology-based tools in EA is giving courage to face the competition within the industry confidently. By being innovative, audit firms can get the competitive advantage in the industry as well.

#### ***4.3. Challenges associated with the use of BD and BDA in EA***

One main challenge stated by many respondents was 'lack of proper knowledge' on such innovative technological advancement. Compared to the external auditors, data analysts have more knowledge and experiences on the BD and BDA.

Further, when analyzing the current practices within the audit companies, it was evident that there is a gap between theoretical definition of BD and BDA and auditors' perception on it (may be due to the comparative lack of knowledge of external auditors on it). To embed such technology into EA procedures, a considerably high knowledge on analytics is required; however, there is a lack of both soft and hard skills of external auditors at audit firms in this regard. Through the interviews conducted with the external auditors at the Big 4 audits firms, it revealed that auditors take the help from data

analysts' teams in their audit companies, to do the data analysis on behalf of them. This demonstrated the lack of capabilities of external auditors in doing advanced analysis such as BDA. Many of the practitioners do not have enough technical skills to handle more complex software and it is another challenge for the use of BDA in EA.

As per Respondent 3, the limited time availability in performing an audit engagement is another reason that led to avoidance of implementing these tools. As per the discussions done with interviewees, only about 2-3 months are allocated to perform an audit. Sometimes, with the requirements of the business clients it is shortened to the 2-3 weeks. On such a background, mainly to avoid any delays the external auditors are reluctant to introduce innovative practices to their auditing procedures and continue with the usual practices they are comfortable with.

Due to the responsibility towards their clients and other stakeholders, auditors are always under high scrutiny by regulators. Thus, this change should also be guided by regulators and legislation (as stated by Respondent 12). In this sense, one of the challenges that auditors are facing is the lack of knowledge of regulators on this topic, partly because SLAuSs do not clearly specify the analytic tools for EA and what to do when BD and BDA are in play. The current support of SLAuSs to the adoption of BDA in EA in Sri Lanka is limited; and it need to be developed from scratch to face the world of audits using BD and BDA in the future.

Furthermore, another challenge stated by all respondents is the high cost associated with the

implementation of advanced technological tools like BD and BDA. The benefit realization against the high set up cost for the external audit companies is not yet analyzed.

The technology adoption curve developed by Moore (2014) can be applied to theorize the challenges associated with the adoption of new technology to the audit companies. The chasms on they discuss represent the barriers to the adoption of a new technology between the different types of technology adopters within an organization. Specifically, in the auditing context the first chasm, between the innovators and the technology adopters can be perceived as the gap between senior-level partners (Leadership of the audit firms) and the frontline external auditors. Even though, there is a commitment of leadership towards the adoption of the advanced technologies like BDA, practical challenges mentioned above delay and demotivate the adoption.

#### ***4.4. Overcoming the challenges associated with the use of BD in EA***

Moore's technology adoption chasm also described the ways of addressing the challenges faced by each chasm. Nevertheless, the most challenging chasm is between early adopters and early majority. While the first ones embrace the new technology as an opportunity and seek to potential applications the second group is loath to change and is only able to adopt the new technology when they are convinced of its benefits. It is exactly same as the current situation of the EA in Sri Lanka regarding the adoption of BDA.

As per the respondents, convincing the benefits of BDA (by way of training sessions to improve the knowledge and understanding on BD and BDA) is much needed to promote the adoption of BDA in Sri Lanka. External auditors have not mastered technological aspects and there is a need of training them to motivate for the use of new technological tools. Responsibility of this lies with the IT department of the audit firms and the leadership of the firm.

Another factor stated by many respondents is the need to create user-friendly tools as a way of overcoming these challenges, since many of the practitioners do not have enough skills to handle more complex software. This factor turns out to be entirely related to the lack of technical skills of external auditors since it inhibits the adoption of BDA. In contrast, interviewee 11 stated that, “*auditors are specialized in accounting, when they are handling IT aspects it could result some drawbacks in the EA procedures.*” In an EA context, this mindset is also important, and auditors should get the knowledge on the use and application of BD and BDA in their procedures, without replacing their job roles.

## **5. Discussion and Conclusion**

Table 2 below is developed to presents a summary of the reasons for the use/non-use in EA industry stated by the respondents, by considering the responses obtained related to why BD and BDA are used in EA and the current state of use.

Overall, coercive isomorphic pressures do not seem to exist in EA in Sri Lankan context and the current standards are inadequate to motivate the external auditors on adoption. Nevertheless, it

receives limited coercive influence as literature also suggested. In contrast, there is a high normative pressure. The mode of normative pressures is the influence from the inter-organizational networks of span organizations. It was evident that the BD and BDA is not much popular within the EA industry and it is adopted only in audits done for special clients who also use BD and BDA. On that sense, mimetic pressure come from the business clients who have fully digitalized their operations and from the competitors within the auditing industry.

Besides those three isomorphic pressures, Commitment of the management (leaders) of the organization was also found as a major influencing factor to use BD and BDA into the EA. This factor cannot be included to the three isomorphic factors because it comes within each organization (internal). Therefore, it was taken separately as another factor which influence the adoption of BD and BDA in EA. However, Alles et al. (2002) made the argument that using BD to EA is a demand rather than a supply-side decision. In contrast, this study suggests that using BD to EA is coming from both demand and supply sides.

Among the main motivating factors identified as a response to the next research question: acting as a facilitator for decision making in day-to-day business operations; and possibility of testing 100 percent of activities without relying on samples were the mostly mentioned. Alles and Gray (2016) states that use of BD and BDA would be a paradigm shift as to how financial statement audits are conducted. By proving that, BD and BDA help to analyze the entire population and it would be a paradigm shift for the EA.

Table 2. Reasons for the use/non-use of BD and BDA in EA in Sri Lanka

<b>Type of Pressure</b>	<b>Reasons for the Use/Non-use</b>
Lack of Coercive Isomorphism	<ul style="list-style-type: none"> <li>❖ Pressure is inadequate to facilitate the adoption</li> <li>❖ No regulations or rules available</li> <li>❖ Not constrained the use of BD and BDA in EA by any standards</li> <li>❖ Only a positive feedback from the regulators for those who used advanced technological tools</li> </ul>
Normative Isomorphism	<ul style="list-style-type: none"> <li>❖ Pressure coming from the inter-organizational network (global network) of the particular firm to maintain the professionalism of the firm</li> <li>❖ Morally governed to deliver quality service to the clients</li> </ul>
Mimetic Isomorphism	<ul style="list-style-type: none"> <li>❖ Pressure coming from the digitalized business entities to perform their audit</li> <li>❖ Pressure coming from the competitive audit firms for some extent</li> </ul>
Other pressures	<ul style="list-style-type: none"> <li>❖ Positive perception of the partners of the audit firms towards the use of technological advancements (Management Intention and Commitment)</li> </ul>

In addition, providing a means to improve quality and efficiency of the financial statement audits by less human involvement and saving the time of the auditors was identified. It was revealed that one of the best ways of complying with the new standards is using advanced analytical tools such as BDA to the EA, and it will become major motivation to use BD and BDA in the future.

Following the structure of the study, findings of the study addressed the next two research questions of how auditors were challenged and how have they overcome the challenges in using BD and BDA for EA. ‘Lack of proper knowledge’ on such innovative technological advancement is the major challenge identified through the findings of the study. In short term this challenge can be overcome by taking the help from the data analysts. However, overcoming this challenge in

long term can be done by convincing the benefits of BDA to the external auditors through the training sessions; and this is much needed to the adoption of BDA in Sri Lanka. Limited time available for the audit engagement and high set up costs for the adoption have identified as the other challenges. Through the findings it revealed that, the need of user-friendly analytical tools is another major way of overcoming challenges. In contrast, it also found that drawbacks can happen when auditors handle the IT aspects which can badly affect the quality of the auditing procedures.

### **6. Implications**

This study contributes to literature on auditing and to practical managers in the following ways. Firstly, it adds fresh information of BDA usage

and motivating and challenging factors in EA in Sri Lanka by offering an empirical investigation. Motivating factors and inhibitors that prevented the adoption of BD into EA were identified and those are critical to the adoption. Secondly, this study conducts as a general qualitative inquiry from multiple perspectives such as auditors, data analysts, regulators and professionals which triangulated the respondents and thus, adds to methodology. Thirdly, the study presents new institutional sociological framework as a model explaining how the different pressures influence to adopt the BDA in EA by facilitating the practical managers.

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