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## **BIG DATA ANALYTICS COMPETENCIES FOR IR4.0 READY ACCOUNTING GRADUATES**

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### **Abstract**

The Industrial Revolution 4.0 is often characterised by data transformation involving a huge amount of unstructured data, also known as Big Data. More advanced analytics techniques are needed to uncover hidden patterns and unknown correlations from the diverse and large datasets known as Big Data Analytics (BDA). BDA is evolving and its impact on the accounting profession is growing. Consequently, accounting graduates need to be competent to understand and utilise BDA. However, studies that examine specific BDA competencies, i.e., knowledge and skills related to BDA needed by accounting graduates are still sparse. Hence, this paper aims to explore the competencies of BDA required for accounting graduates from the perspective of educators. A qualitative approach by using semi-structured interviews was conducted involving eleven participants who were lecturers from three public universities and two private universities in northern, central and southern Malaysia. Our study suggest that accounting graduates need to possess basic BDA knowledge in order for them to handle big data in their future profession. In addition, they also must be competent in mathematical, statistical, machine learning, analytical and data mining skills. By acquiring these competencies, accounting graduates are expected to perform their tasks more effectively in the IR4.0 era.

**Keywords:** Industrial Revolution 4.0, Big Data Analytics, Accounting Graduates, Private and Public University

### **Introduction**

The Industrial Revolution 4.0 (IR4.0) is expected to change how we live, work, and communicate that eventually leads to changing business models and employment trends. Nowadays, organizations depend on sophisticated business processes and analytics in order to be competitive in the global market (Abbasi et al., 2016). This development is characterized by the huge amount of data produced commonly referred to as Big Data (Abbasi et al., 2016; Verschience, 2014). Big Data represents a high volume of data with different data types accumulating at a rapid velocity (McAfee & Brynjolfsson, 2012; Provost & Fawcett, 2013; Verschience, 2014; Molina, 2019). Big Data is not just “extra” data but it is massive, mixed and very unstructured. The daily amount of data produced by various business activities is expected to be growing at an exponential rate (Verschience, 2014). Nowadays companies need to leverage on voluminous structured, unstructured and semi-structured data to find their unique patterns on the different behavior of customers (Kaplan, 2016). Big Data reshapes organizations' operations in its technology, business process and how data is being analysed, hence the use of Big Data Analytics (BDA).

BDA is defined as the analysis of massive amounts of data using mathematical and statistical approaches that enable firms to detect patterns, identify anomalies, and generate valuable knowledge (Muhammad, R.N et al., 2020). From the accounting profession perspective, BDA opens an opportunity for accounting professionals in shaping their role in the near future (Gamage & Pandula, 2016). With BDA, accountants should be able to use it to increase operating efficiencies, assess risks and identify advantages and weaknesses through analysis. The importance of BDA is highlighted by various accounting education providers in recent years. For instance, the Association to Advance Collegiate School of Business (AACSB) requires BDA as part of an accounting program in which graduates need skills in creating, sharing, evaluating and interpreting data (Schneider et al., Mesa 2019). In the current digital era, the accounting and finance professionals are required to handle technical and non-technical skills but the qualified candidates are still insufficient (Krumwiede, 2016).

The presence of Big Data will likely require more significant changes than ever before and expects an increase in both analytical skills and database skills being added to the accounting curriculum. Not only is Big Data changing how accounting education will be performed, but it will also have an impact on who will analyse the data, given one of the characteristics of Big Data tools is self-service (Gantz & Reinsel, 2012; Lycett, 2013). Krahel and Titera (2015) believe that Big Data will result in more analyses being done by accountants rather than data analysts. According to Tarmidi, Ahmad and Roni (2018) local public universities need to equip the students with at least basic knowledge and technical skills in managing and operating data mining systems. Hence, relevant educational content-related information and a better teaching assessment is needed (Daniel, 2015). However, Yoon et al. (2015) suggest that there will not be enough trained accounting analysts to audit all the available data. In this way, BDA is expected to be used in academic since learning analytics can improve the quality of education and optimize the curriculum (Strang, 2016) among other benefits of data-driven decision making (Hargitai et al., 2021; Muhammad et al., 2020; Sedkaoui et al., 2019; Tasnim et al., 2020).

In Malaysia, the Ministry of Higher Education is still preparing all graduates to embrace IR4.0 (Brahim & Dahlan, 2019) including future accountants. Researchers predict that IR 4.0 will necessitate profound changes in major aspects of education in the content, style of delivery or pedagogy, and the structure of education (Lase, 2019). The unique responsibility of universities lies in training the specialists who will shape the digital transformation in the future as well as those high-skilled graduates who will work in a digitally transformed society (Jorgensen, 2019). Within the accounting field, the accountants must have the ability to leverage on BDA for the purpose of increasing operating efficiencies, assessing risks and identifying advantages and weaknesses in businesses. Rezaee and Wang (2019) suggest that BDA and forensic accounting could be integrated into the existing curriculum as it can improve forensic accounting education and practice. Similarly, in the auditing field, knowledge and skills in BDA would enable auditors to perform “continuous auditing” to look for ways to improve the cost-benefit ratio of internal audit functions (Capriotti, 2014). As such, accounting educators need to equip accounting graduates with BDA competencies, i.e., BDA knowledge and skills, that are required to change the traditional accounting role towards more technologically competent accountants (Gamage & Pandula, 2016; CGMA, 2013).

The incorporation of BDA in education is critical since it allows for all higher education institutions to be relevant, creating values, and remain competitive (Brahim & Dahlan, 2019). Content and delivery changes in accounting education are necessary to ensure graduates have a workplace with relevant knowledge and need to keep up to date with global accreditation standards and professional qualifications (Al-Htaybat et al., 2018) especially in BDA. The CGMA report (2013) has listed the five broad characteristics of future finance leaders, i.e., ability to identify which data points are useful in understanding what drives the business, clear sense of what customers care most with ideas on how to track this, ability to embrace new forms of data with relative ways to incorporate into decision-making, comfortable with uncertainty including the reality that Big Data may not provide definitive answers, and ability to explore new ways to interpret data to better inform management.

While there have been many calls for modifications in accounting education over the past 30 years in

response to changes in the financial environment and technology (Albrecht & Sack, 2000; McKinney et al., 2017), not many changes have been observed in practice. However, before any modification is made to the accounting curriculum to be in line with the development of Big Data Analytics, education providers need to have clear insights on the specific competencies needed to embrace Big data. More specifically, the nature of competencies in terms of knowledge and skills of BDA needed by the accounting graduates must be addressed first. Hence, the main purpose of this research is to generate insights into the BDA competencies in terms of knowledge and skills required by accounting graduates within selected universities in Malaysia.

### Methods

This study used the qualitative methodology of research in addressing the research questions. Qualitative research is “any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification” (Strauss & Corbin, 1998; p:11). According to Denzin and Lincoln (2000), qualitative research is considered as a naturalist paradigm since rich data is derived from a natural setting obtained using a flexible research design, rigorous methods of analysis and interpretations. In this study, the research issues were addressed using semi-structured interviews that have been conducted through face-to-face and online platforms. Apart from that, this study also reviewed relevant documents, specifically the course outline of various accounting programmes offered by the selected universities. For the semi-structured interviews, 11 lecturers from three public universities located in northern, central and southern Malaysia participated; and three lecturers from two private universities located in the central region of Malaysia were also involved. Notably, the selection of the lecturers was made based on purposive sampling strategy. Using this strategy, only those who were expected to have sufficient knowledge and teaching experience in accounting and BDA were chosen.

Typically, the participants were permanent staff at the academic department such as the lecturer, faculty dean, and program coordinator. Prior appointments were made with the relevant interviewees. The interview meeting schedule was pre-arranged at the inception of the study while all appointments were made through ad hoc basis, as and when deemed appropriate. At the start of each interview, participants were promised confidentiality to facilitate candid responses. An interview protocol was used as a guideline during the interview. It contained information on the background of the interviewee, the particulars of the meeting that took place, brief objectives of the interview, interview questions and a closing remark. However, interviewees were allowed to develop their own explanations, and cues were taken from these for subsequent discussions and probes. The interviews lasted on average of one hour to one and a half hours per session. The data was recorded and subsequently transcribed.

This study utilised the thematic approach in analysing the findings. Hence, the presentation of the findings was made according to several themes which include familiarizing with the data, generating initial codes, searching for themes, reviewing potential themes, defining and naming themes and producing the report. More specifically, the data analysis process involves a six-step process which consist of (1) organize and manage data; (2) review and explore data, (3) re-read and examine data; form initial codes; establish themes or patterns and place coded data in themes, (4) refine the codes, (5) report findings and (6) interpret findings, analyze and synthesize findings by linking to insights and literature.

### Findings and Discussion

Findings of the study indicate that future accounting graduates need to gain BDA knowledge and skills in order to perform tasks more effectively. From the knowledge perspective the findings suggest that accounting graduates need to master two types of knowledge. Firstly, there is a need for accounting graduates to have knowledge on BDA but only at a foundation level. Secondly, these graduates also need to possess basic knowledge on software that can be used to analyse Big Data. Learning the software will enable them to process the data that will allow them to predict and prescribe business decisions. For example, a participant (IV1) noted that:

*“Business Analytics mines data and drives future business planning as it converts big data into actionable intelligence. It helps to answer, “What happens next?” (predictive) and “What should we do?”*

*(prescriptive).”*

In addition, it is important for future accountants to be open to learning, reskilling and upskilling in a dynamic business environment where Big Data is utilised. Accounting graduates can use software that is already familiar to them to analyse Big Data, such as Microsoft Excel. Basic software knowledge will help them understand and generate meaningful patterns from the vast amount of data to be handled in their day-to-day job.

A participant (IV2) commented:

*“We do not only teach basic (Microsoft) Excel but we also teach them at the advanced level. For example, students will do data analytics using (Microsoft) Excel. They will learn how to create a system, how to create a dashboard, and present the data. That is how we integrate our subject with the needs of industry”*

This finding suggests that even though specific softwares such as Microsoft Power BI and Tableau are available for BDA, more advanced analytics can be performed by accounting graduates using software already taught within the current accounting curriculum. Therefore, the accounting graduates can still analyse Big Data using softwares that they are familiar with, yet powerful enough to handle Big Data such as Microsoft Excel.

Having basic BDA and software knowledge is sufficient for accounting graduates without the need for them to have advanced understanding of BDA. These findings could be attributable to the fact that it is important for future employees to demonstrate hybrid talent that are able to manage end-to-end processes particularly in a Big Data environment. These findings are consistent with Vasarhelyi et al. (2015) who noted that future accounting graduates would also benefit from exposure to emerging BDA to enhance their future career development. This is further supported by a participant (IV10) who stated that:

*“If they have this knowledge, what I can see is that they have a future not only to just work in the accounting field but it could enhance the quality to provide them a better job decision”*

Our findings show that Big Data had significant impacts on the skills needed by future accountants. It is important for the accounting graduates to be able to capture data analytics capabilities. This study suggested that various skills are needed for accounting graduates to adapt in the Big Data environment. The multidisciplinary skills that are required include mathematical, statistical, machine learning, analytical and data mining skills. Apart from these skills, another important skill that is needed by accounting graduates is their creativity skill. Such creativity skill will help accountants to offer solutions in a more creative way with the aim to facilitate businesses in formulating their strategies. Our findings support prior studies such as Ghasemaghahi and Calic (2020) which noted that the combination of creativity and BDA may be more conducive to the development of new strategies for firms to compete.

This study suggests that competencies in Big Data Analytics can improve the graduates' quality for better employment. However, our findings indicate that existing accounting knowledge and skills taught are still relevant. As noted by a participant (IV5):

*“The new skills are not replacing what they are currently taught but serves to enhance the knowledge and skills that they have now.”*

These findings are consistent with prior studies (e.g., Gamage, 2016; Ahadiat & Martin, 2015; PwC, 2015). Accounting graduates also must have the skills set to extract value from Big Data through advanced analytics (PwC, 2015). Accounting programs are faced with the challenge of training students that are more marketable than ever before. No longer will teaching the traditional subjects be sufficient to make students qualified for the scarce positions that are available. Accounting students' education should take a much broader approach and go beyond conceptual and technical accounting knowledge (Ahadiat & Martin, 2015). According to Gamage (2016), accounting and professionals should not focus only on accounting information systems but also on information storage, data management and analyzing the data

pattern. The incorporation of BDA within the existing accounting curriculum is viewed as timely considering the need for accountants to stay relevant in the business and finance landscape. As pointed out by Gamage (2016), there is an increasing demand for software engineers and data scientists within the accounting professions. Failure to keep abreast with Big Data development may lead accountants to miss employment opportunities. These findings are consistent with (Jorgensen, 2019) whereby the unique responsibility of universities lies in training the specialists who will shape the digital transformation in the future as well as those high-skilled graduates who will work in a digitally transformed society. These skills enable them to transform traditional business operations into contemporary data-driven insights such as real time, valuable, and how genuine the data.

### **Conclusion**

This study aimed to generate insights into the Big Data Analytics competencies in terms of BDA knowledge and skills required by accounting graduates. Our findings indicate that future accountants need to have basic knowledge on BDA for them to adapt to employment in the digital era. They also need to have several critical skills including mathematical, statistical, machine learning, analytical and data mining skills. This research has broad practical implications. Firstly, it aims to fill the gap in the current literature on the incorporation of BDA within existing accounting courses. Given that the use of BDA is evolving and its impact on the accounting profession is growing, BDA competencies, i.e., knowledge and skills, required by accounting graduates should not be overlooked. Secondly, this study highlights the need for education providers to embark on the incorporation of BDA within accounting courses if they have not done so. Such efforts will ensure that the accounting profession will remain relevant in the future.

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### **Author Contribution**

NI Mohamed Sufian – conceptualization, data collection and analyse, Writing - original draft, Writing – review and editing; ES Kasim – supervision, Writing - original draft, Writing – review and editing; N Md Zin – supervision, Writing - original draft, Writing – review and editing; N Md Noor; WA Wan Nasrudin – data collection and analyse, Writing - original draft, Writing – review and editing.

### **Conflict of Interest**

Author declares no conflict of interest.

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