A Review of Scholarly Discourses on Accounting Technical Skills for IR 4.0

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With advancements in information technology and large-scale globalization of economies in the previous decade, the working landscape of professional accountants has changed. This study looked into how academia should react to the demand from the industry that graduates in accounting have higher-level technological skills applicable to an IR 4.0 workplace. The study performed a cross-sectional analysis of scholarly discourses in journal editorials and commentary sections. The first finding showed that Big Data and Disruptive Technologies could change the structure of the finance department from pyramidal to either diamond or pillar-shaped. Secondly, accounting graduates need technical skills in information systems, data analytics, and associated software tools. Lastly, it is recommended that Advanced Data Analytics course should be taught to university accounting students so that they are able to interpret other departments' data science results. This study contributes to the perceived gap in the accounting curriculum as reported in professional and scholarly publications.

Keywords: scholarly discourses, accounting technical skills, IR 4.0, accounting curriculum and accounting graduates

INTRODUCTION

The working atmosphere in which professional accountants work and function has changed. These shifts were mainly attributable to advancements in information technology and the large-scale globalization of economies in the previous decade (Tan & Laswad, 2018). Many termed this the Fourth Industrial Revolution (IR 4.0), which requires a new set of skills for the professional accountant (Gray, 2016) and their education (World Economic Forum, 2016).

IR 4.0 will profoundly impact the world, business, and how humans conduct their daily jobs; it is 'the future world of work' (Schwab, 2016). Sani (2018) forecast that there would be a decrease in the demand for back-office tasks such as data entry and bookkeeping, and these tasks would be replaced by artificial intelligence (AI) and global outsourcing. Burritt and Christ (2016) mentioned that in IR 4.0, accountants will be less involved in automated operations but must focus more on the companies' big-picture strategies.

To remain relevant, they must increase their awareness and understanding of current developments, improve existing skills, and collaborate with other professionals.

Educators have consistently expressed concern about the degree to which academia interacts with the industry, which leads to an awareness of current issues impacting their graduates (Andiola et al., 2020; Moll, 2019; Dzuranin et al., 2018). This concern has been articulated in the editorial and commentary pages of leading academic journals, which serve as the foundation for developing the research questions for this paper. Notwithstanding that, consultants and practitioners have voiced similar concerns about academia actively engaging with the industry to identify their needs for the new workforce (Pappas et al., 2018). Lozada et al. (2019) mentioned that the impact of Big Data has become a top matter for academics who seek to explain the phenomenon and its implications.

Several recent studies have delved into the multiplicity of necessary skills that are looked for in industry (Kwarteng et al., 2022, Oesterreich et al., 2019, Mikalef et al., 2018, p. 503, Gray, 2016). Such studies highlight significant gaps in the graduates' skills and those needed in industry. The necessary skills include programming, research method, data handling, simulation tools, soft skills, domain knowledge, and good teamwork abilities. The need for such highly skilled individuals is emerging as the value of data analytics grows in today's industry ecosystems. As a result, in the coming years, a significant focus will be on developing course curricula and supporting learning resources that promote education in such diverse skill sets, as well as rapid adaptation in response to new technologies and business demands (Pappas et al., 2018).

Thus, the primary aim of this paper is to enquire how academia can meet the call of the industry for accounting graduates to have higher-level skills relevant to an IR 4.0 workplace. For this purpose, the paper is structured as follows: a problem statement about the existence of the skills gap (technical skills), followed by the research questions, research methods used, analysis of findings, and conclusions.

PROBLEM STATEMENT

In recent years, graduate work readiness has emerged as an essential criterion for employment (Cavanagh et al., 2015). In 2016, INTI International University & Colleges (INTI Malaysia) and International Data Corporation (IDC Malaysia) conducted a study on graduate readiness for the IR 4.0 workplace. The study involved 560 respondents comprising students, graduates, and parents. The study's key findings were that students, graduates, and parents need more clarity on IR 4.0; students feel unprepared to join the IR 4.0 workforce, and tertiary education may need to do more to prepare students for the workplace (Sani, 2019).

Such findings need to augur better with the current job market expectations. According to Breur (2015), companies already thrive on analytics, e.g., by using data to determine which market segments to pursue and which to avoid. Relating to the skills required for accountants, a survey of the industry by the Institute of Management Accountants (IMA, 2016) revealed that managers most frequently pursue financial analysis skills from new hires (87%), followed by budgeting, planning, and forecasting (85%), organizational analysis (82%), and cost management (81%). The study observed substantial skill gaps in several fields employers value the most, including recognizing key data patterns, data mining and extraction, analysis of the operation, technical aptitude, mathematical modeling, and data analysis (IMA, 2016).

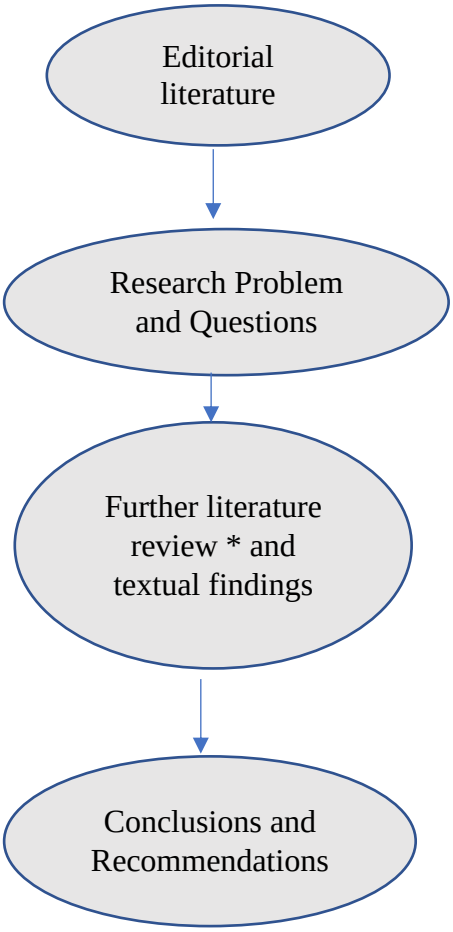
In line with these new developments, accounting academics have become more concerned about the future of higher accounting education. Undeniably, accounting programs will become more interdisciplinary with a teaching content delivered from different departments (PWC, 2015), like IT or Statistics. Furthermore, the World Economic Forum's (WEF) Future of Jobs report suggests that approximately 35% of the accountancy profession's core skills will likely change between 2015 and 2020 to meet the demands of IR 4.0, thereby ensuring the global relevance of the profession (World Economic Forum 2016). Hence, academics should consider the impact of IR 4.0 so that future professional accountants can be educated in a direction (path) that maintains the profession's relevance in the future (Craig, 2015).

To achieve this new direction, accounting academics must develop diverse skills and abilities to take the lead in this new landscape. Unfortunately, the insight from faculty shows that there are few successful practices of implementing Big Data competence into the accounting curriculum. A successful example

reported by Stancheva-Todorova (2019) is regarding the School of Accountancy at the Rawls College of Business, Texas Tech University, which has already included several core and elective modules on data analytics in the accounting curriculum. Also, St. Mary's University's Greehey School of Business opened a new Bachelor of Business Administration degree program in Accounting and Data Analytics. The Faculty of Economics and Business Administration at Sofia University "St. Kliment Ohridski" opened a new master's program in Accounting and Big Data Analytics.

Therefore, to match the industry's expectations, universities must assess how well their current programs provide training and real-world insights to graduates entering the workplace and what they need to do to scale up beyond theoretical and academic teaching. A textual analysis of the editorial literature will assist in confirming the problem and research questions. The research process is depicted in Figure 1.

FIGURE 1
THE RESEARCH PROCESS



*Following the citations referred to in the editorial literature

REVIEW OF EDITORIAL LITERATURE AND RESEARCH QUESTIONS

An editorial by Moffitt (2018: p. 4) noted the comments by Breuer (2015) that finding accounting and finance experts with business analytics expertise is difficult, making it much more challenging for managers to hire, build, and retain people with essential skills (the research problem). Further, the Association of Advance Collegiate Schools of Business (AACSB, 2014) recognized that accounting students need

additional technical and analytical skills. This evidence reveals that there is a skills gap that exists within data analytics (research gap). Agnew (2016) and PwC (2015) stressed that auditors with data analytics skills and the capacity to view financial statements critically are in high demand (research gap).

In another editorial comment (Huerta & Jensen, 2017), the editors agreed that, in the wake of IR 4.0, accountants should use one of three techniques suggested by Davenport and Kirby (2015) to prevent losing their jobs due to automation (RQ1). First, "stepping up" with advanced degrees provides skills that cannot be easily automated and brings creativity to problem-solving. Second, "stepping aside" from tasks that can be automated, and third, "stepping in" to become the computer's overload by learning to review the computer's work in the same way that senior accountants review staff work. The editors stated that accountants are accustomed to dealing with numeric statistics, but Big Data requires free text, images, videos, and other data sources that can be analyzed (RQ2). Handling and interpreting these data necessitate the development of new analytical and technological skills, including managing a wide range of data, selecting suitable analytical instruments, and analyzing the findings (RQ3) (Wang, 2015: p. 6). The panel also noted a need for guidance on applying data analytics in audit engagements, including how to utilize it at various phases with acceptable data and consequences (RQ3). According to the panel, most accounting students only enroll in one AIS course, which is inadequate to assess the analytic skills that students need if analytic skills are only learned in AIS courses (RQ4).

However, in an editorial by Liu (2014), with the support of advanced data analysis technologies, the accountant's position has shifted from the manual measurement and manipulation of transaction data to the selection of preferred techniques for automated selection and analysis of business data. As a result, accountants' future skill sets will include, among other things, proficiency in the application of advanced data processing techniques (RQ5). In addition, Pickard (2015: p. 2) described how recursive partitioning demonstrated how accountants could mine a vast collection of customer cost and profit data, find trends, and use those patterns to maximize the profitability of current customers and determine the features of potential productive customers (RQ6).

Lastly, Huerta and Jensen (2017: p. 106) mentioned that accountants using Big Data visualization tools have to be data-driven and able to frame questions correctly for data scientists (RQ7). The creativity to ask insightful questions and the analytic skills to answer them will allow accountants to grow as strategic business partners.

The following research questions arise from the above editorial literature review. The relationship between the research questions is illustrated in Figure 2.

RQ1: *Through automation, how will Big Data and Disruptive Technologies shape the finance function and the skill set of future accountants?*

RQ2: *How will Big Data, Disruptive Technologies, and automation in other business functions change the management information system?*

RQ3: *How will the new management information systems impact the skill sets of future accountants?*

RQ4: *Should a specific course in information systems (i.e., AIS) be taught to accounting graduates?*

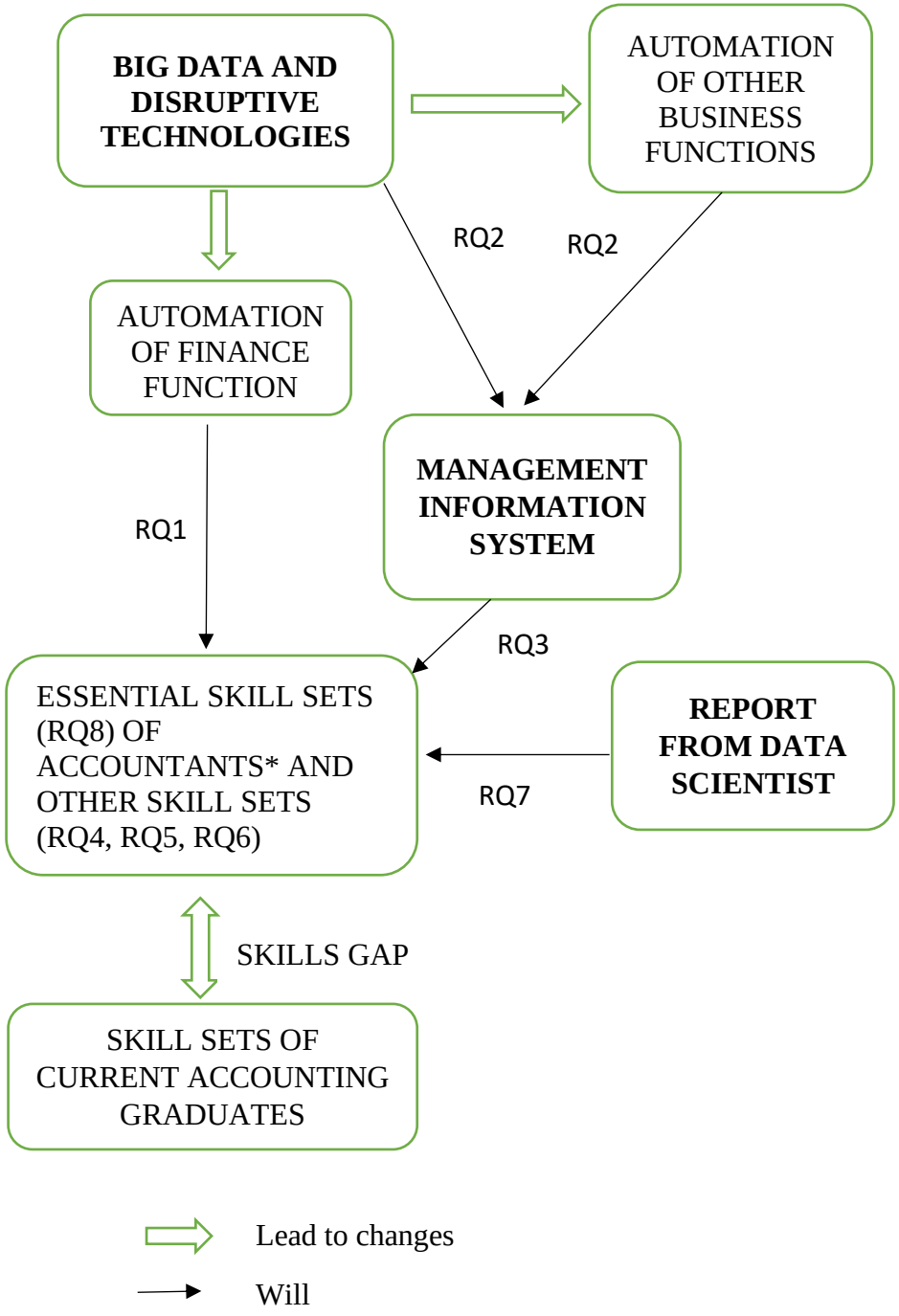
RQ5: *Should a specific course in data analytics (instead of business analytics) be taught to accounting graduates?*

RQ6: *Should programming be taught to accounting students?*

RQ7: *Does the accountant require new skill sets to interpret the analysis and reports from the data scientist?*

RQ8: *What basic skill set is required to be taught in an accounting program?*

FIGURE 2
RESEARCH QUESTIONS THAT RESULTED FROM AN EDITORIAL LITERATURE REVIEW



* Accountants include internal and external auditors
Tangible objects are in bold

RESEARCH METHODS

A cross-sectional analysis of scholarly discourses was performed in journal editorials and commentary sections. The findings were used to identify this study's research problem and questions. Though not done before by other researchers, open coding of the editorial literature is the best way to discover the current issues, problems, and trends in academic writing, which will eventually culminate into research questions. For a more in-depth analysis of the research questions and following the research framework in Appendix 1, we probe into the specific literature addressed (cited) in the journal editorials and commentaries. Open coding of all 338 business articles extracted from the SCOPUS Q1/Q2 database (related to digitalization) can reach the same objective. However, this is laborious, and there is a tendency to fail to see and understand the real issues raised by scholars and the research problem because of a preoccupation with minor details.

As Henriette et al. (2015) suggested, the ScienceDirect database from 2013 to 2022 was searched. Many academics regard 2013 as the year IR 4.0 began; this was when it became part of the German Government Economic Policy (Lasi et al., 2014; Ning & Liu, 2015). Using the root word "digital" (as suggested by Reis et al. (2018) on the ISI database), 338 Scopus Quartile one and two business journal articles were extracted, 38 of these were editorial literature, of which ten were relevant for this study. Selecting only high-tier academic writing ensures higher precision (reliability) in the open coding of journal text segments using MAXQDA software, thus removing the need for intercoder reliability testing. Intercoder reliability testing is only necessary when the text, in interview transcripts, e.g., could have different interpretations. This is not the case with succinctly and lucidly written journal texts.

However, every journal article is different; therefore, case studies (of "similar cases") should not be constituted for constant comparison. This research aims to explore further the general concepts mentioned in the editorial journal texts (i.e., an inquiry) and not perform constant comparisons to develop new concepts. Important journal articles cited in the coded editorial text segments are extracted and analyzed manually (cognitively) to illuminate the general concepts and to assist in answering the research questions. At this stage, there is a strong possibility that more new sub-concepts will emerge to further illuminate the general concepts.

FINDINGS AND DISCUSSION

The findings will be discussed in the order of the research questions (RQ).

RQ1: *Through automation, how will Big Data and Disruptive Technologies shape the finance function and the skill set of future accountants?*

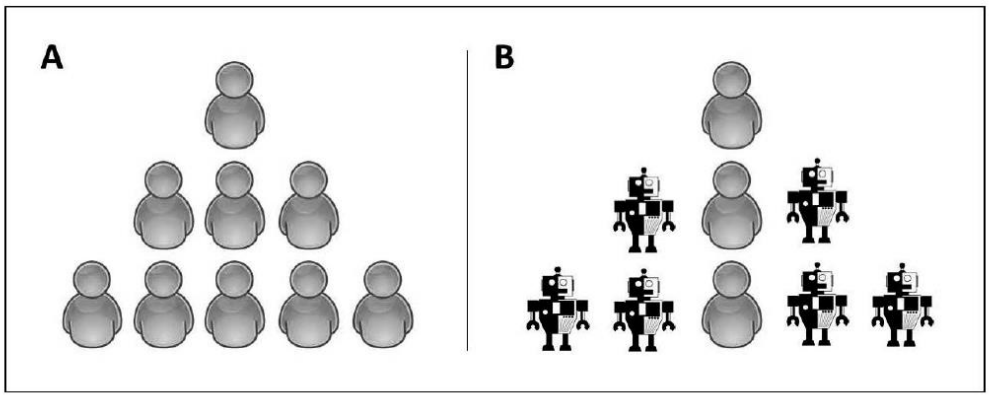
Schäffer & Weber (2019) provided empirical evidence that the digitalization of the finance department is still in its infancy, despite all the lip service. The accounting profession has been recognized in the mainstream and business press as a discipline that faces an increased risk of automation (Dhar, 2017). Therefore, training, education, and "stepping up with advanced degrees" are critical to prevent a net loss of jobs (Huerta & Jensen, 2017; Davenport & Kirby, 2015) and to avoid automation.

Frey & Osborne (2017) have identified bookkeeping, clerical accounting work, and tax planning among the most vulnerable to automation (with a likelihood of 98–99%). In the accounting practice, Zhang (2020) has reported using financial robots with Artificial Intelligence (AI) to recognize data, enter invoices, and generate financial reports automatically. Besides accounting, Zhang (2020) mentioned taxes using Robotic Process Automation (RPA) to do repeated operations, such as sending applications to a tax authority portal. Krahel & Titera (2015) argue that data collection in auditing will be increasingly automated, and audit testing will be performed on the entire population of transactions, thus reducing the importance of audit sampling.

These new developments would inevitably reduce the finance function in size (Frey & Osborne, 2017), and new opportunities and roles will arise (Schäfer & Brueckner, 2019). As a result, it is predicted that the structure of the finance department will change from pyramidal to diamond-shaped as more staff move up

(or move out) the pyramid to engage in higher value-generating tasks. However, Moffitt et al. (2018) have a slightly different view of the transformation and eventual shape of the finance function (a pillar instead of a pyramid), as illustrated in Figure 3.

FIGURE 3
THE INSERTION OF ROBOTIC DEVICES INTO HUMAN PROCESSES



Panel A: Abstraction of the Shape of a Typical Organizational Structure
Low-level, less-skilled workers are more numerous than highly skilled workers, resulting in a pyramid shape.
Panel B: Abstraction of the Effect of Automation on the Typical Organizational Structure
Robots will initially replace more low-level jobs than higher-level skilled positions. The resulting organizational structure is fundamentally the same shape as the previous structure, but the human component resembles a pillar instead of a pyramid.

(Moffitt et al., 2018; Chappell, 2017)

Whether diamond-shape or pillar-shape, replacing humans with robots (termed RPA) is certain (Moffitt et al., 2018). This will allow businesses to expand without hiring more employees (Chappell, 2017).

RQ2: *How will Big Data, Disruptive Technologies, and automation in other business functions change the management information system?*

According to Dai & Vasarhelyi (2016), with the intense use of sensors, Cyber-Physical Systems (CPS), Internet of Things (IoT), and smart factories, the business world is moving forward toward a highly automated, highly flexible, and highly interconnected environment, with real-time capabilities of corporation, fault detection, prediction, and decision making. Issa et al. (2016) mentioned that "with such large databases, traditional audit procedures become less effective and efficient, which necessitates a rethinking of the way audits are conducted".

Another change brought about by AI is the obsolescence of the manual pre-processing and examinations of certain documents (e.g., contracts). Using various AI methodologies, such as text mining, these procedures will be replaced by automated AI analytics that will likely produce more accurate and efficient results. However, exposure to large amounts of information can lead to increased ambiguity, information overload, difficulty identifying relevant information and patterns, and suboptimal audit judgment (Brown-Liburd et al., 2015). All these significantly impact the Management Information System (MIS).

RQ3: *How will the new management information system impact the skill sets of future accountants?*

The auditing profession should adapt to the changes in MIS and leverage the emerging technology to expand the scope of auditing, shorten timing, improve accuracy, and eventually enhance the assurance level of the whole business (Dai & Vasarhelyi, 2016). Another aspect impacted by AI is the training provided to

new auditors. Accounting curricula will need to be adapted to accommodate the new requirements of the future auditor (Peterson, 2016). Organizations that want to compete in the digital economy will have to invest in various resources, including people, processes, and technology of data and analytics (Carlsson, 2017). Keys & Zhang 2020 suggested that academia should "develop exercises that cover a wide range of RPA applications, including logging into an enterprise resource planning (ERP) system, extracting data from the Internet, and entering information from Excel to Pdf, e.g., using UiPath as the software of choice."

RQ4: *Should a specific course in information systems (i.e., AIS) be taught to accounting graduates?*

Information System is so important to an accountant that a specific Accounting Information System (AIS) was taught to accounting students before IR 4.0 started; this trend is expected to continue. Before IR 4.0, academics debated how to make the content of an information system course more relevant to accounting students. AACSB 2018 Standard A5 stressed that accounting degree programs should include learning experiences that develop skills and knowledge related to integrating information technology (current and emerging) in accounting and business. The new curricula will consist of three primary components:

- Information systems and business processes, which will include data creation, manipulation/management, security, and storage.
- Data analytics including, e.g., statistical techniques, clustering, data management, modeling, analysis, text analysis, predictive analytics, learning systems, or visualization.
- Development of information technology agility among students and faculty, recognizing the need to continually learn new skills required by accounting professionals.

Though not explicitly mentioned, this recent standard highlights that the new accounting curricula must be tailored specifically for accounting, i.e., AIS, to reflect these three components.

RQ5: *Should a specific course in data analytics (instead of business analytics) be taught to accounting graduates?*

Practitioners emphasize audit hires who possess skills in data analytics and the ability to interpret the results (Agnew, 2016). Data analytics serves a multitude of disciplines. The business realm may stretch from the general operations management and supply chain to a niche like web marketing. For accounting, AICPA & CIMA (2019) surveyed accounting department chairs in the US, where 59.3% plan to introduce an accounting data analytics course in the next three to five years, and 66.5% prefer an accounting data analytics course like the general business analytics course. A specific data analytics course will become more important when integrating data analytics into accounting courses, in which case Dzuranin et al. (2018) proposed three approaches: focused, integrative, and hybrid. In their study, faculty evidence showed that most faculty members favored the hybrid approach, i.e., a hybrid of the focused and integrative approaches. Thus, the case for a specific data analytics course for accountants (AIS) is strong (indicatively 66.5%).

RQ6: *Should programming be taught to accounting students?*

There have been persistent demands in the Pathways Commission's Report of 2015 for the need to teach some technologies. Various groups (e.g., PwC, 2015) have made calls for an overhaul of the accounting curricula to include more programming courses (e.g., Python, R, Tableau). However, Earley (2015: p. 499) & Andiola (2020) cautioned on the lack of consensus from practice about which software tool to use, and thus accounting academics may make their own choices (e.g., Tableau, IDEA, and Excel) to use and teach in the new accounting curriculum. According to Alles (2015), reducing the technical skills required to use Big Data tools is key to increasing their adoption. End-user data analytics tools that do not require extensive technical expertise allow users to focus on the results rather than the system's technicalities (Moffitt, 2018; p. 4). According to Huerta & Jensen (2017), a basic understanding of the

underlying programming is sufficient to enable the auditor to use computer-assisted audit techniques, e.g., using SQL, to extract data from a relational database. Not only that, but accountants must also be able to use visualization tools as part of effective data analytics.

RQ7: *Does the accountant require new skill sets to interpret the analysis and reports from the data scientist?*

Findings by Schäffer & Weber (2019) indicate little interaction between finance controllers and data scientists, with only 17% of respondents indicating an interaction. One possible reason is that CEOs prioritize areas that directly add to the creation of corporate values, such as marketing and supply chain (Schäffer & Weber, 2019: p.6). In addition, Oesterreich (2019) found that in very large organizations with a high degree of specialization, the controller might not be involved in data analytics as it falls under the job profile of a data scientist or analyst. In such working environments, the controller merely interprets and communicates the insights from data science. However, controllers are more likely to be responsible for data analytics in companies with a lower degree of job specialization, such as SMEs. This represents a strong argument that accounting students must learn sufficient data analytics to interpret the findings of the data scientist.

RQ8: *What basic skill set should be taught in an accounting program?*

Spraakman (2015) surveyed the software competencies that are desirable to employers and concluded that accounting graduates need to demonstrate intermediate-level Excel skills, meaning that accounting graduates should be adept in using v-lookups, filters, functions, pivot tables, graphs, charts, sorting data in different ways, automatically filling columns and rows, and linking spreadsheets together. Proficiency in Excel is the most critical requirement for extracting data from databases, problem modeling, problem analysis, and presenting results to managers. The evidence suggests that employers require accounting graduates to be intermediately proficient in other Microsoft tools, including Word, PowerPoint, and Outlook, and have sufficient familiarity with an ERP system to understand how it is structured, how to navigate through it, how to process transactions, and most importantly, how to undertake the analysis of data from the ERP system (like drill-down analysis of financial numbers to identify how they are explained by underlying non-financial drivers). As for data analytics, the findings from RQ4, RQ5, and RQ7 confirmed that it must be taught to accounting students up to a sufficient level of proficiency to interpret data science analysis (refer to RQ7).

CONTRIBUTIONS

This paper was written when there were numerous ambiguities surrounding the suitable curricula for accounting. It highlights the discourses among scholars on what should be taught to accounting students to prepare them for the entry-level graduate workforce. According to Kavanagh & Drennan (2008), many of the higher-order skills employers expect from new undergraduate hires can only be developed with guidance 'on the job'.

This paper took a different study approach from Kwarteng & Mensah (2022), wherein they ranked their survey findings of 18 important qualities required to conduct accounting tasks. Contrary to our review of journal papers which revealed that knowledge of word processing software, spreadsheet software, database software, and accounting software were among employers' highest priorities in new accounting hires, their data ranked these skills 8th, 13th, 17th, and 15th, respectively. However, they acknowledged that technical skills were underdeveloped in IT, which might be an early challenge that accounting graduates will encounter (ibid: p. 7). This implies that accounting graduates will need further IT training and development by their future employers (ibid: p. 8). Thus, the authors recommended that curriculum space be made for IT training in the institutions of higher learning in Ghana (ibid: p. 8). For this paper, we delineate the scope and extent (minimum threshold) to which the technical skills related to information systems, data analytics,

and related software tools should be taught to accounting graduates. However, due to the changing nature of technology, accountants must engage in lifelong learning if they wish to remain relevant in the workforce. For this reason, equipping the accounting student with the fundamentals contained in the three themes must take precedence over ready-made software and technologies.

The theoretical contribution is to recognize the need for an accounting curriculum change process in universities and to close the gap between academia and industry. Business faculties need to revise their traditional curriculum in light of the comments made regarding individual controllers (Kolthof et al., 2017; Schafer & Brueckner, 2019) and auditors (Agnew, 2016) that need accountants to acquire new skills with data analytics capabilities and the ability to interpret the financial results (Huerta & Jensen, 2017). The Malaysian Qualification Accreditation (MQA) agency that governs all private learning institutions in Malaysia has released a new Program Standard requiring Business Analytics to be included as a core module in all business programs. However, many universities lack faculty resources and are not ready to implement changes in curricula, though they know its importance to employers. Table 1 below shows what happened in one university when they implemented readily available software into their degree programs.

TABLE 1
BACHELOR OF BUSINESS ADMINISTRATION (HONOURS)
(HOSPITALITY MANAGEMENT)

List of modules and technology used.

Name of Courses	Classification	Credit Value	Technology to be used (Ready-made)
Principles of Management	Core	3	N/A
Principles of Marketing	Core	3	N/A
Business Law	Core	3	N/A
Management Accounting	Core	3	SQL
Operations and Project Management	Core	3	Microsoft Excel/IDB Cloud PMS
Housekeeping Operations	Specialization	3	Microsoft Excel
Introduction to Hospitality Industry	Specialization	3	N/A
Professional and Academic Development I	Core	3	N/A
Introduction to Finance	Core	3	SQL
Organizational Behavior	Core	3	N/A
Business Communication	Core	3	N/A
Tour Planning and Operation	Specialization	3	**GDS (ex. Galileo)
Professional and Academic Development II	Core	3	Microsoft Office Package
Research Method	Core	3	SPSS
Food and Beverage Service Management	Elective	3	**POS system
Hotel Operations Management	Elective		N/A
Tourism Planning and Impacts	Specialization	3	N/A
Global Cross-Cultural Management	Core	3	N/A

Name of Courses	Classification	Credit Value	Technology to be used (Ready-made)
Catering Management	Specialization	3	**POS system
Human Resource Management	Core	3	SQL Payroll
Tourism and Recreation Management	Elective	3	Designing Software/ Apps (E.g., Canva)
Customer Service in Hospitality Industry	Elective		N/A
Contemporary Issues in Tourism	Specialization	3	N/A
Events Management	Elective	3	Designing Software/ Apps (E.g., Canva)
International Tourism and Hospitality Marketing Planning	Elective		N/A
Tourism and Hospitality Entrepreneurship	Core	3	Microsoft Excel
Economics	Core	3	Microsoft Excel/SPSS
Tourist Behavior	Specialization	3	N/A
Front Office Management	Specialization	3	IDB Cloud PMS
Ethics in Business	Core	3	N/A
Hospitality Service Quality Management	Specialization	3	Google Forms
Strategic Management in Hospitality Industry	Core	3	N/A
Hospitality Project	Core	3	SPSS
Sustainable Tourism	Elective	3	N/A
Tourism and Hospitality Facilities Management	Elective	3	N/A
Industrial Work Experience (Internship)	Core	3	N/A

SQL: Search Query Language , IDB: , GDS: Global Distribution System, PMS: Performance , SPSS: Statistical Practice for Social Sciences , POS: Point of Sale ,
** *To be requested*

CONCLUSIONS AND FUTURE RESEARCH

The study aimed to investigate how best academia can meet the call of industry for graduates to obtain higher-level skills relevant to an IR 4.0 workplace. The study has conducted a cross-sectional analysis of scholarly discourses to determine research problems, gaps, and questions. All eight research questions have been analyzed, leading to the following study conclusions.

First, it is predicted that the structure of the finance department will change from pyramidal to diamond- or pillar-shaped as more staff are removed or moved up the pyramid to engage in higher value-generating tasks. Further research on upskilling operational staff (e.g., bookkeeping staff) is welcomed. Also, the notion that more businesses are expecting their controllers to shift roles from an employee to a "business partner" (by assisting in higher decision-making) needs to be explored further to determine whether a good understanding of programming and data analytics is sufficient to perform this new role. This will extend

the current authors' view that equipping the accounting student with the fundamentals of programming takes precedence over teaching ready-made software technologies due to the requirement for lifelong learning of emerging technologies. Though both are important, software technologies change over time, but fundamental programming rarely changes.

Second, fresh accounting graduates need to possess new skills, such as data analytics, to use software tools, and interpret data analysis results. Many diverse skill sets (mentioned in Mikalef et al., 2018, p. 503, and PwC, 2015) can be met by introducing more advanced programming languages and data analytics into the business faculty programs. However, if objections to a standalone module on Basic Business Programming crops up, the faculty must be innovative enough to consider another module for Advanced Data Analytics. Other soft skills, e.g., critical thinking, communication skills, or report writing, would have been part of a university's curriculum even before the business curriculum transformation.

Third, it is recommended that an Advanced Data Analytics course should be taught to university accounting students, in addition to a Basic Data Analytics course, to narrow the skills gap and ensure students can interpret data science reports and reports from other departments. Finally, note our earlier point that controllers are more likely to be responsible for data analytics in companies with a lower degree of job specialization, such as SMEs (Oesterreich et al., 2019).

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