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Preparing accountants of the future: A programme in accounting data and analytics

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PREPARING ACCOUNTANTS OF THE FUTURE: A PROGRAMME IN ACCOUNTING DATA AND ANALYTICS

CHAPTER 11

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Disruption of the accounting profession

The accounting profession is rapidly evolving due to technological innovations. Technologies such as the Internet of things, smart sensors, cloud computing, robotics, and artificial intelligence are combining to disrupt the way that businesses operate. It is predicted that, over the next decade, information technology (IT) will significantly transform the accounting profession.

IT is expected to enhance transparency, accuracy, and the communication of financial information as well as offer opportunities for accountants to create value, perform more in-depth analyses, and provide timely financial advice. Some of the IT-enabled transformations in accounting will involve automation of not only mundane bookkeeping tasks but also complex, multifaceted processes including financial closing processes and fraud and forensic accounting. The accounting profession expects the adoption of smart software and analytics that will enable better and near real-time reporting, allowing accountants to transition from retrospective to predictive analysis, and highlighting the interconnectedness of financial and non-financial performance.

In 2020, CPA Australia commissioned a research study to examine the impact of technology on the desired skills of early career accountants[1]. The study highlighted concerns in the accounting profession that graduate talent does not have the right mix of skills and is not adapting to evolving skill requirements. The study identified technological literacy as the most highly desired skill set for accountants joining the profession and highlighted that the perceived impact of technology on success in the accounting profession was greater among early career accountants than managers. Similarly, the Singapore National Skills Framework for the Accountancy sector[2], which guides individuals to acquire future-ready competencies as the accounting profession continues to transform in the digital age, has identified data analytics as one of the top emerging skills required in the accounting profession.

It is clear that practitioners and academics in the accounting profession need to rethink about the future of the profession and to take active steps towards embracing digital transformation.

Incorporating technologies in accounting education

Although technological advances are set to transform the accounting profession in the coming years, there is a significant shortage of accounting professionals who possess the relevant skillsets to exploit these advances. To effectively leverage technology, accountants will need to develop new paradigms and skills. Within this regard, there have been calls for university programmes capable to equip accounting students with technology skills that they will bring to the future workplace.

Many employers have also shared their view that to better prepare students for the opportunities and challenges ahead, universities should infuse analytical exercises into existing curricula in order to help students develop proficiency in data and analytics, in addition to core accounting skills. Currently, firms are often forced to assemble two separate groups – one with expertise in accounting and the other with expertise in technology – to work together on complex issues requiring skillsets from both groups.

[1] *https://content.cpaaustralia.com.au/podcast/5-ways-technology-changing-accounting-skills*

[2] *https://www.sac.gov.sg/skills-framework*

The Association to Advance Collegiate Schools of Business, also known as AACSB International, is a leading international accreditation body for university accounting and business programmes. It connects educators, students, and business to groom the next generation of great leaders. AACSB recommends that accounting degree programmes should include learning experiences that develop skills and knowledge related to the integration of IT in accounting and business. These experiences include development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage within and across organisations. This is articulated in AACSB's International Accounting Accreditation Standard A7 (Information Technology Skills and Knowledge for Accounting Graduates)[3].

Further, the International Federation of Accountants also highlights that relevant skillsets, including those in IT, statistics, and data modelling, should be integrated in university programmes for both current and future accountants.

In Singapore, there has also been extensive discussion on the role of IT in accounting. For example, in 2015, the Singapore government established a committee on the future economy to develop economic strategies that can position the country well for the future. As part of the committee, a working group on legal and accounting services was formed. In its 2017 report, the working group acknowledged the role that technology will play in the jobs of accountants and recommended that universities should embed technology into the accounting and law curriculum. According to the Skills Framework for Accountancy published in 2020, digitisation and data analytics are among the core skills which will grow in demand as the accountancy sector continues to transform.

Consistent with these views, the Pathways Commission on Accounting Higher Education of American Accounting Association, a premier community of accountants in academia, highlights in its recommendation the need for universities to develop curriculum models, engaging learning resources and mechanisms for easily sharing them. Further, the commission also notes that to achieve this, vital programmes, courses and approaches require systematic attention to curriculum, pedagogy, and opportunities for renewal. Specific objectives articulated to accomplish this recommendation include engaging the accounting community to define the body of knowledge considered to be the foundation for accounting's future curricula and implementing curricula models for the future.

Case study: SMU school of accountancy accounting data and analytics second major programme

(i) Background

In response to the call to prepare accounting graduates for digital transformation, SMU School of Accountancy (SOA) launched the Accounting Data and Analytics (ADA) Second Major programme in 2018 that students can pursue to complement their Bachelor of Accountancy degree programme[4].

[3] *https://www.aacsb.edu/accreditation/standards/accounting*

[4] *https://accountancy.smu.edu.sg/bachelor-accountancy/curriculum/2nd-major-accounting-data-and-analytics*

The ADA programme is the first of its kind in Singapore. It aims to equip students with the relevant skills in data and analytics, which are in demand in the accountancy sector. This is particularly important considering that the need for accountants to become more tech savvy and conversant with data has been identified as one of the important ways that can help the accounting profession continue to thrive amid digital transformation. Universities need to ensure that their accounting curricula meet these needs.

During the programme development phase, SOA conducted focus group discussions with 23 representatives of major employers of accounting graduates in Singapore to gain insights into the relevance of a programme in accounting data and analytics for the accounting profession. Specifically, 15 participants were from the Big Four accounting firms and held senior positions such as audit partner, director, and chief information officer while eight participants were from major financial institutions and held senior positions such as head of finance and general manager of financial management.

Participants were supportive of the ADA programme and provided valuable insights. They agreed that accountants of the future should be exposed to new and emerging technologies that are relevant to the work of accountants. Participants commented that the following would form the core data technology skillsets required of accountants of the future: (i) data management, (ii) data modelling and visualisation, and (iii) statistical tools/programming.

(ii) Curriculum Structure

Students need to complete eight courses to gain the ADA second major. The curriculum is designed based on three pillars: (1) data technology, (2) analytics electives, and (3) accounting analytics capstone. The structure of the ADA programme is illustrated in Figure 1.

Data Technology (Pillar 1) **(4 compulsory courses)**	**Electives (Pillar 2)** **(Any 3 courses, selected list)**
▪ Accounting Information Systems ▪ Business Data Management ▪ Data Modelling and Visualisation ▪ Statistical Programming	▪ Forecasting and Forensics Analytics ▪ Analytics for Value Investing ▪ Audit Analytics ▪ Auditing Information Systems ▪ Blockchain Applications in Financial Services ▪ Accounting Data and Analytics Work-Study Elective
Accounting Analytics Capstone (Pillar 3) **(Compulsory, Experiential learning)**	

Figure 1: Curriculum structure

Students will take four compulsory courses under the data technology pillar to equip themselves with basic data and analytics skill-sets useful for accountants. These courses include accounting information systems, business data management, data modelling and visualisation, and statistical programming.

In the second pillar, students will learn to apply these basic data and analytics skillsets by completing three electives courses. Electives available include forecasting & forensic analytics, analytics for value investing, audit analytics, auditing information systems, blockchain applications in financial services, and work-study elective.

Lastly, in the third pillar, students are required to apply the skills learned in the first two pillars by completing a compulsory accounting analytics capstone course. A key pedagogical innovation of the ADA second major is the compulsory accounting analytics capstone course that employs the unique award-winning SMU-X experiential learning pedagogy, which will be discussed below. Completing a capstone course helps students integrate and apply the knowledge, skills and abilities.

(iii) Learning Outcomes

The learning outcomes for the five compulsory courses are:

(a) Accounting Information Systems: Our students can use data flow diagrams and system flowchart to document business processes, analyse internal control weaknesses and recommend business process improvements.

(b) Data Management: Our students can apply data modelling techniques to design a database.

(c) Data Modelling and Visualisation: Our students can use appropriate modelling techniques to solve accounting and business problems.

(d) Statistical Programming: Our students can implement statistical analysis operations using a programming language to solve accounting and business problems.

(e) Accounting Analytics Capstone: Our students can apply data analytics skillsets to deliver solutions for real-world projects.

Please see appendix for course synopses.

(iv) Collaborations with Industry Partners

The compulsory accounting analytics capstone course is delivered via the SMU-X experiential learning pedagogy. The SMU-X experiential learning pedagogy was introduced in 2015 as a university-wide programme[5]. Students have the opportunities to work in groups to help companies solve real-world problems.

SMU-X is an experiential learning framework which calls for students to take on real-world challenges by collaborating on projects with corporates, non-profit and government organisations. The framework represents a paradigm shift in the traditional approach to teaching and learning; from being teacher-centred to active learning by students while working on the real-world problems. SMU-X also encourages instructors to collaborate closely with industry partners.

[5] *https://x.smu.edu.sg/*

The SMU-X experiential learning pedagogy is built on four principles (see Figure 2).

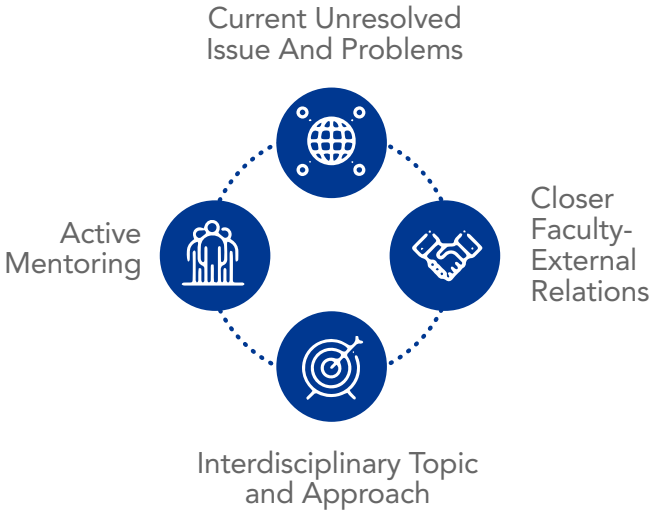

Figure 2: Four Principles of SMU-X Experiential Learning Pedagogy

The four principles are:

(a) Project-based experiential learning – combines academic with experiential learning through the heavy use of projects from industry partners;

(b) Interdisciplinary approach – challenges students to use their knowledge and skills to tackle real-world problems through interdisciplinary approaches and activities;

(c) Active mentoring – partners with corporate, non-profit and government-sector organisations. Industry partners and faculty are involved in active mentoring so that students benefit most out of this collaborative relationship;

(d) Tripartite learning loop – students get a better understanding of what it means to use theory learnt outside the classroom; faculty learn how real-world adapts theories; industry partners deepen their own learning through faculty and students' findings. This inculcates in our students, faculty and industry partners the value of continuous learning in a volatile, uncertain, complex and ambigious world.

Through the SMU-X principles, the accounting analytics capstone course provides students with opportunities for active and collaborative learning, interactive experiences, access to subject-matter experts from academia and industry, and a deepened understanding of diversity and interconnectedness. Below are three examples of industry projects completed by students during the compulsory accounting analytics capstone course.

(a) Singapore Exchange (SGX)[6]

SGX requested the students to devise a solution for their current revenue forecast process. The present system of SGX requires human intervention to manually sift through various new data sources to determine the inputs for their forecast. This method may lead to higher chances of inaccuracy as significant human judgement is used to determine these inputs. The student group proposed converting the semi-automated revenue prediction process to a fully automated one in order to streamline the process and eliminate the human judgement bottleneck. This would enable a standard operating procedure, reduce total man-hours and improve the process accuracy over time.

(b) Seng Hua Hng (SHH) Foodstuffs Pte Ltd[7]

SHH requested the students to develop in-house data analytics capability to help the company achieve its strategic goals. Previously, SHH would rely on estimates to make key strategic decisions such as to determine annual production capacity. The key challenge of utilising estimates was the lack of accurate demand forecasting on a periodic basis and the absence of important financial information that would support the risk assessment of expansion into new foreign markets. The student group leveraged on predictive analytics to find valuable insights such as expansion plans for both domestics and overseas, new product introduction possibility and better estimation of future financial targets.

(c) XDel Singapore[8]

XDel was confronted with payables-related challenges. Previously, their finance department used manual processes, which was very time consuming and prone to errors. Due to the manual processes, there were certain issues such as difficulties in reconciling payments, delayed payments to suppliers and non-payment to suppliers. The student group assisted their finance department to automate their processes. They also derived a formulae for the company to calculate the cost per driver which they could implement in their cost management tool for better costings. XDel implemented the students' solutions and experienced a reduction in late and non-payments.

Increasingly, higher education has been called upon to train students to be more agile and capable of dealing with complex issues and systems at work. Therefore, there is a need for an education where students are rooted in content knowledge and be provided with hands-on learning that mirrors real-world problems, coupled with interdisciplinary work opportunities.

(v) Work-Study Programme

Under the ADA second major programme, students can also opt for the Accounting Data and Analytics Work-Study programme (WSP)[9]. Under this WSP, students will have the opportunity to undergo a 20-week extended internship at EY in Singapore across its service lines in assurance, tax, strategy and transactions, and consulting.

[6] *https://blog.smu.edu.sg/academic/schools-libraries/smusoa/solving-real-world-issues-through-smu-x-accounting-analytics-capstone-project/*

[7] *https://accountancy.smu.edu.sg/student-project-showcase/project/undergraduate-project/building-house-data-analytics-capability*

[8] *https://x.smu.edu.sg/project-showcase/xdel-singapore*

[9] *https://news.smu.edu.sg/news/2021/05/19/smu-accounting-data-and-analytics-work-study-programme-industry-experience-ey*

SMU aims to put in place work-study options where students may undergo longer internship durations to better interlace institution-based learning with structured on-the-job training and to facilitate more impactful work opportunities within the attachment company. This is another collaboration with industry partners, besides the accounting analytics capstone course.

Before embarking on the extended internship, students are required to complete two courses (data modelling and visualisation, and business data management). During the extended internship, students will alternate between working four days at EY, and studying on campus for one day each week. In contrast, students typically complete a full-time 8~10 week internship during their holidays. Through the 20-week programme, students will work on a data analytics project. Students will learn about the forms of data, how to analyse data and draw insights from it. Importantly, they will also gain exposure to and better understand how a professional services organisation like EY leverages data-driven insights to deliver exceptional service to clients.

Conclusion

The ADA programme is expected to benefit students by equipping them with relevant skillsets required for accountants of the future. Even as the accounting industry seeks to incorporate technology into its processes, there remains an acute lack of accounting professionals who possess the necessary technology skills required. As such, students who complete both a Bachelor of Accountancy degree and the second major in accounting data and analytics would be well placed to fill the "skills gap" that has developed in the accounting industry, thus improving their career prospects upon entering the industry.

Given the lack of accounting professionals who possess the necessary technology skills in the marketplace, employers can benefit from the ADA programme training accountants with key skills in data and analytics. Given the potential for technology to improve productivity and spur growth in the accounting profession, the hiring of accountants who also possess critical data and analytics skills to drive the implementation of technology would give firms a key competitive advantage over their competitors. A focus on incorporating data and analytics in accounting education is timely.

Appendix: course synopses

Data Technology (Pillar 1)

1. Accounting Information Systems

This course adopts a business process approach to examine accounting information systems concepts and explores the critical characteristics of information that must be considered in systems design, implementation and application. This course will expose students to systematic documentation and analysis of key business processes, database modeling, and the role of internal control in an accounting system and processes.

2. Business Data Management

This course will cover fundamentals of relational database theory, important data management concepts such as data modeling, database design, implementation, data access, and practical data-related issues in current business information systems. Upon successful completion of this course, students will be able to understand the role of databases in integrating various business functions in an organisation, query a database using Structured Query Language and gain familiarity with some commercial database tools (MS VISIO, MySQL).

3. Data Modelling and Visualisation

This course will introduce a variety of quantitative techniques used in the development, implementation, and utilisation of analytical data models that accountants regularly use in decision making. It will cover techniques including regression analysis, trend analysis, optimisation, text analytics, and simulation. Visualisation provides an important means through which accountants can communicate insights obtained via data modelling to their intended recipients. This course will introduce students to key principles and techniques for data visualisation. Students will create visuals including dashboards and interactive visualisations for decision making in the accounting context.

4. Statistical Programming

Given the heavy use of statistics in analytics applications, this course aims to provide students with the foundation in statistical programming that is crucial to all four stages of analytics (descriptive, diagnostic, predictive and prescriptive). This course will focus on the use of R Programming to develop students' statistical knowledge. Students can then build on their foundation in R and apply it to analytics applications, specifically in the accounting context.

Selected Elective Courses (Pillar 2)

5. Forecasting and Forensic Analytics

This course explores how data can be used to solve accounting problems in across financial accounting, managerial accounting, audit contexts. Students will use gain exposure to techniques to explore how financial and non-financial data is used to forecast events, detect financial discrepancies and frauds, predict corporate default, optimize operations, and determine business strategy. Some advanced analytics methods such as text analytics, neural networks and deep learning will also be introduced.

6. Analytics for Value Investing

This course examines quantitative models used by securities investors and asset managers to identify and interpret patterns in accounting data for making value-based fundamental investing decisions. The course will involve writing programming codes to analyse large-scale archival data, draw inferences from the statistical results, and back-test the models for their predictive power. The skills taught in this course would be useful for students who wish to pursue a career in securities investing, asset management, investment analytics or financial consulting.

7. Audit Analytics

This course examines the application of data analytics in audit based on an underlying risk-based methodology with real-life examples. Students will also learn about practical aspects in the audit analytics process such as extraction, transformation and loading of data as well as the actual execution of audit analytics tests and visualisation of the results in software such as Tableau and/or Qlikview. By the end of the course, students, in their respective groups, are expected to conceptualise the application of audit analytics in real-life companies through development of prototype dashboards.

8. Auditing Information Systems

Information systems provide core business functions and hold essential and sensitive information critical to successful business operations. IT Auditors must understand the concepts of information systems development, operation, data management, and the range of relevant and essential controls to ensure the timely delivery and integrity of business processes and the protection of business data. This course provides an understanding and assessing of the primary controls required to manage the business and information security risks of business information systems. The course is structured around the five domains of knowledge for the Certified Information Security Auditor (CISA) qualification.

9. Blockchain Applications in Financial Services

This course explores blockchains and smart contracts in the context of financial services. The fundamentals of blockchains and smart contracts are first explained and then the similarities and differences of public and private blockchains are shown. Various blockchain platforms are considered as well as the end-to-end implementation of a range of services, for example supply chain financing. The course has hands-on development, deployment and execution of smart contracts using Solidity for Ethereum and the FISCO BCOS blockchain platform. Emphasis is placed throughout the course on analysing real-world situations using case studies and gaining hands-on experience with financial systems.

Accounting Analytics Capstone (Pillar 3)

10. Accounting Analytics Capstone (SMU-X)

This SMU-X course offers an experiential learning opportunity that allows students to translate classroom knowledge and theory into practical solutions for real organisations. Through this student consultancy project, students learn how to solve complex business problems with guidance from the faculty and project sponsor mentors, from problem definition to final client presentation – while simultaneously testing their skills in real world settings. The course will focus on examining accounting processes and applying data-driven analytics and insights to identify and create accounting delivery efficiencies.

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