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Taiwan Accounting Association

Marc A. Rubin
Dean and Mitchell P. Rales Chair in Business Leadership
rubinma@miamioh.edu

December 2019

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Data Analytics and Accounting
THE
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Topics for Discussion

Goal of accounting
Change in business models and technology
Overview of Big Data and Analytics
Data Analytics in the Accounting Profession
The Profession's Response
Challenges in the Accounting Academy
What Should Change in Teaching and Research
How to Change?

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Accountants need to have data analytic skills

It is best to have a plan and be deliberate

Consider a combination of stand alone courses and integration into existing courses

Conduct impactful research

Are we leading or lagging?

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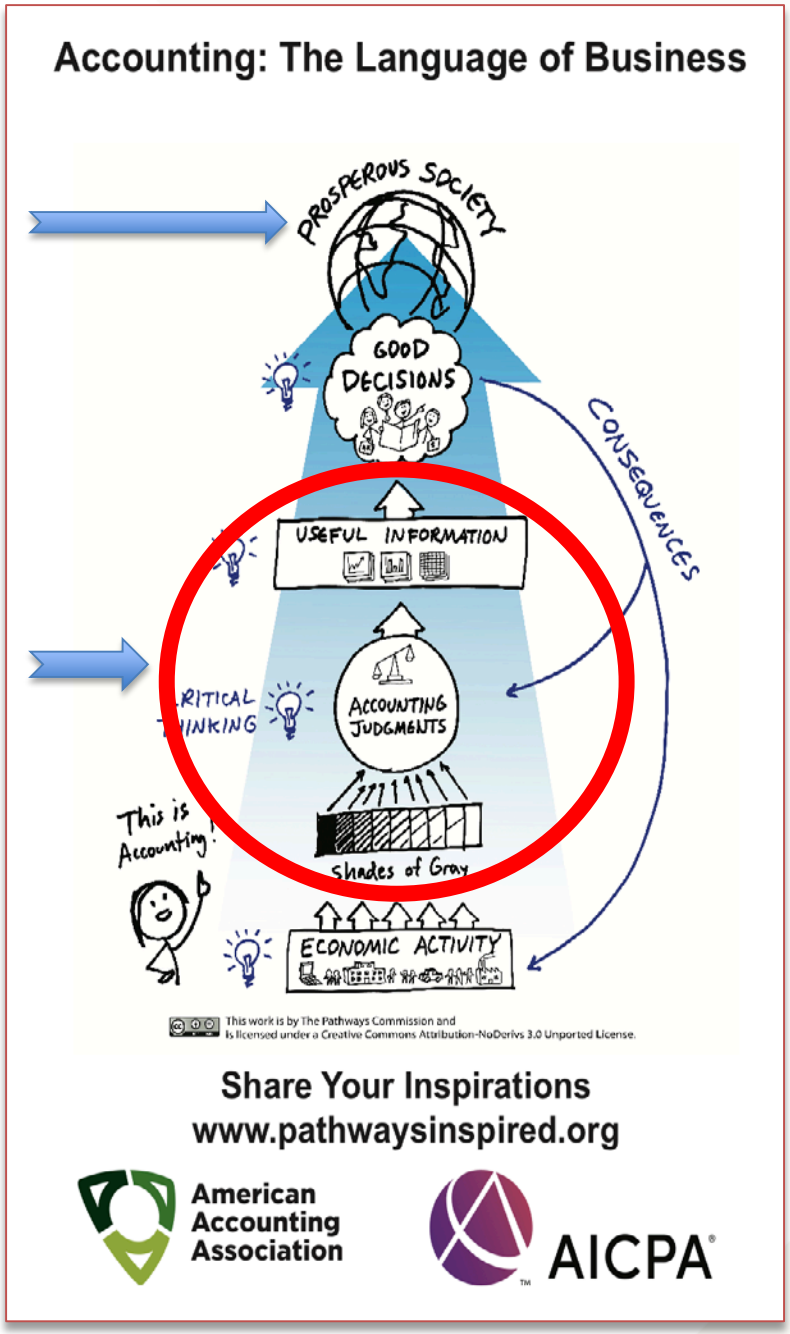
What is the responsibility of the accounting profession and the accounting academy?

GOAL

Role of Accounting



The Pathways Commission Charting a National Strategy for the Next Generation of Accountants
July 2012

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PATHWAYS – RECOMMENDATIONS

Recommendation 1: Build a learned profession for our future by **purposeful integration** of accounting research, education, and practice for students, accounting practitioners and educators

Recommendation 4: Develop curriculum models, engaging learning resources and mechanisms for easily sharing them as well as **enhancing faculty development** opportunities in support of sustaining a robust curriculum

Recommendation 7: Convert thought into action by establishing an **implementation process** to address these and future recommendations by creating structures and mechanisms to transition accounting change efforts from episodic events to a more continuous, sustainable process.

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PATHWAYS

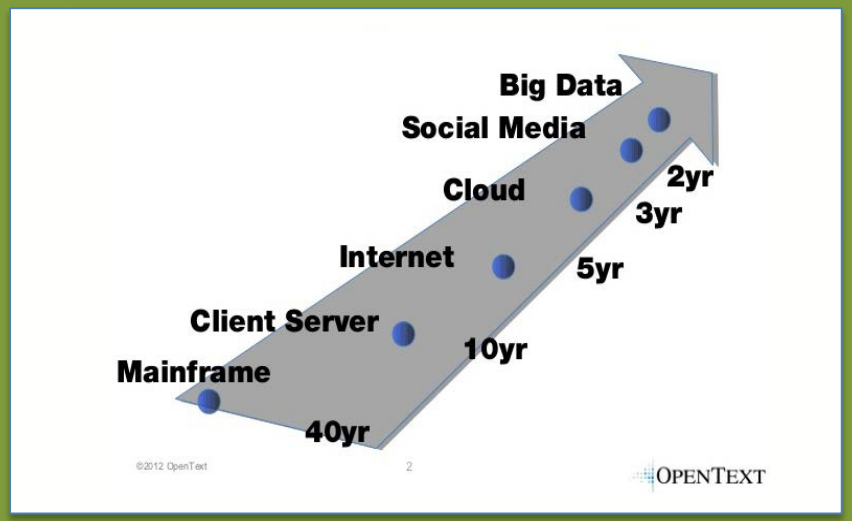
SOME OF THE EXISTING IMPEDIMENTS FOR IMPLEMENTATION

1. Failure to acknowledge what drives faculty to change
2. Delays in incorporating effective practices in pedagogy because faculty lack experience, knowledge and development opportunities
3. Lack of appreciation or understanding of the importance of sound pedagogy and professional relevance. Without the commitment of accounting educators and practice colleagues to challenge the institutional cultures and structures at the root of these impediments, sustaining renewal and innovation in accounting education will continue to be limited

CHANGES in BUSINESS

Quay Consulting

RATE OF CHANGE IS
ACCELERATING



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IMPACTFUL
TECHNOLOGIES

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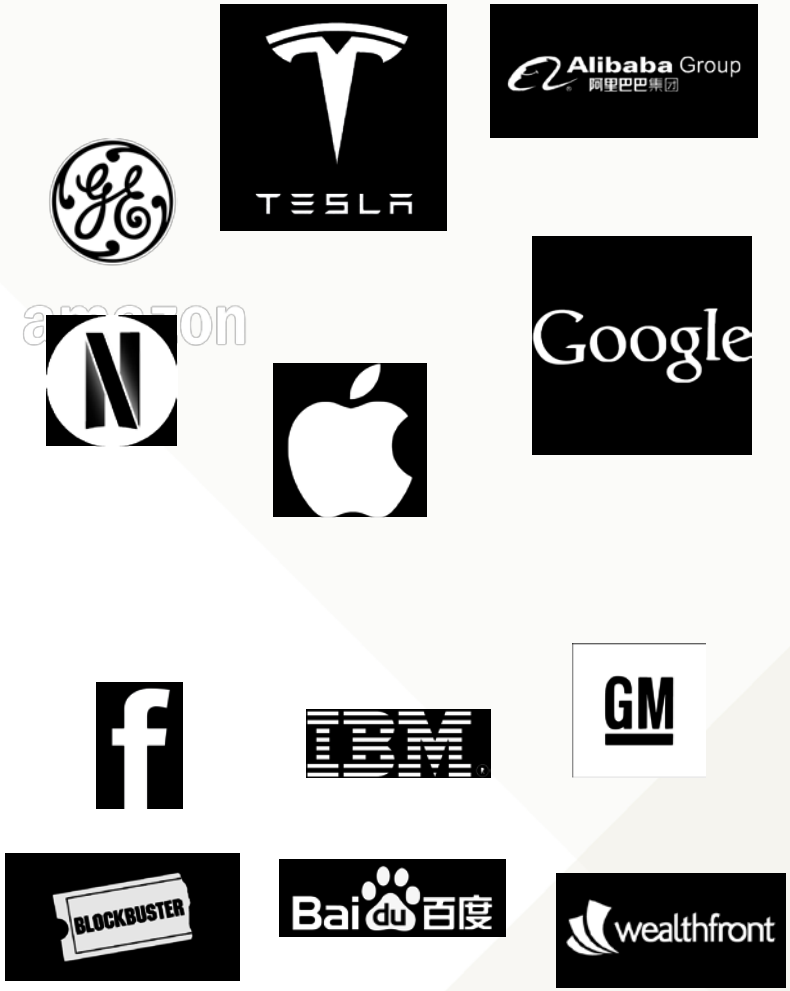
HOW IS BUSINESS CHANGING?

- The disruptors and the disrupted
- New products and services
- New business models
- New methods and processes for conducting business



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THE DISRUPTION GRID

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Drastic falls in cost are powering another computer revolution. The Economist September 12, 2019

The magic of computers is that they provide in a machine an ability—to calculate, to process information, to decide—that used to be the sole preserve of biological brains.

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Attracted by the lure of new business, and fearful of missing out, firms are piling in. Computing giants such as Microsoft, Dell, Intel and Huawei promise to help industries computerise by supplying the infrastructure to smarten up their factories, the sensors to gather data and the computing power to analyse what they collect. They are competing and co-operating with older industrial firms: Siemens, a German industrial giant, has been on an iot acquisition spree, buying up companies specialising in everything from sensors to office automation.

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One way to understand the IoT says Martin Garner at ccs Insight, a firm of analysts, is by analogy with another world-changing innovation. Over the past century electricity has allowed consumers and businesses at least in the rich world, access to a fundamental, universally useful good—energy—when and where they needed it. The IoT aims to do for information what electricity did for energy.

The Internet of Things will bring the internet's business model into the rest of the world

The Economist September 12, 2019

Data are the currency of the online world, gathered, analyzed, sold and occasionally stolen in a business model that has built some of the world's most valuable companies—but which is attracting increasingly unfriendly scrutiny from governments and regulators, and which its critics decry as "surveillance capitalism".

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BIG DATA and ANALYTICS

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Big data is a term that describes the large volume of data – both structured and unstructured – that inundates a business on a day-to-day basis. But it's not the amount of data that's important. It's what organizations do with the data that matters. Big data can be analyzed for insights that lead to better decisions and strategic business moves.

SAS Institute

Towardsdatascience.com

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Simply stated, **data analytics** are what you learn from an analysis of data or data sets, whether you "crunch the numbers" manually or use data analytics tools.

When combined with Big Data, we see data analytics as technology tools that review those huge sets of data in order to gain insight.

Thomson Reuters 8/23/16

Information-management.com

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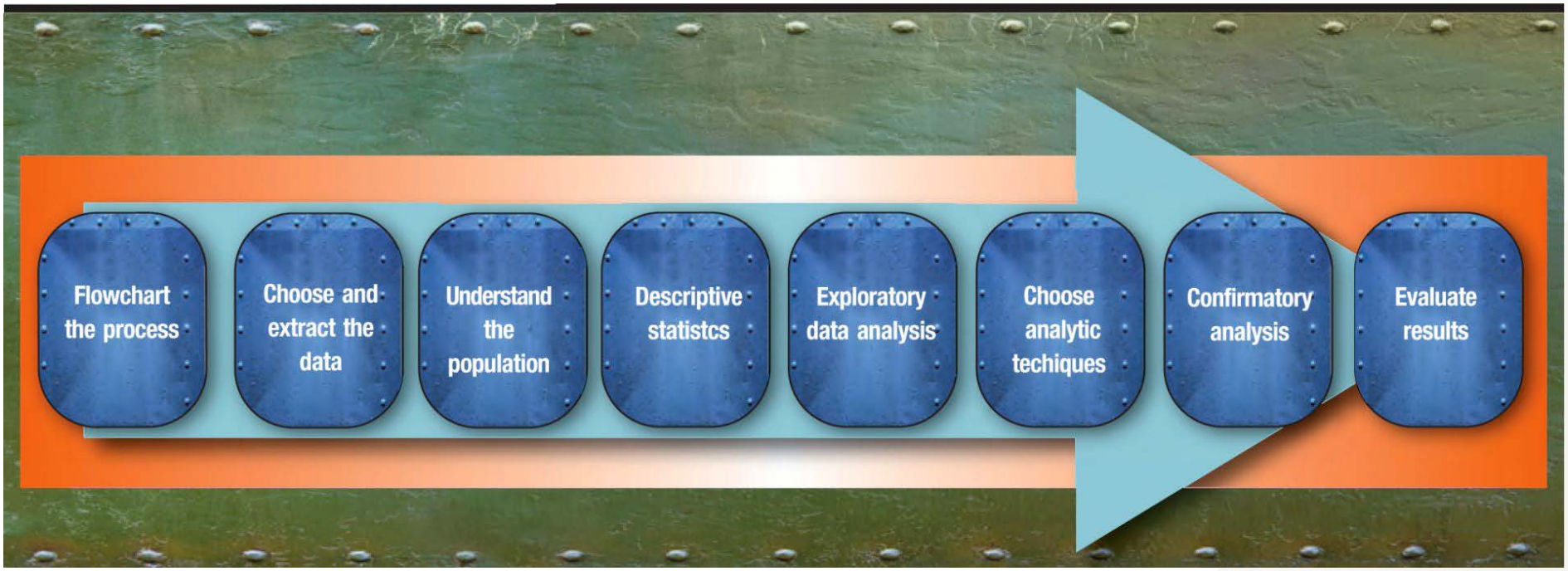
Types of Data Analytics

4 types of data analytics

Type of analytics	Explanation	Examples
Descriptive analytics	Provides insight based on past information. What is happening?	Used in standard report generation and in basic spreadsheet functions such as counts, sums, averages, and percent changes and in vertical and horizontal analyses of financial statements.
Diagnostic analytics	Examines the cause of past results. Why did it happen?	Used in variance analyses and interactive dashboards to examine the causes of past outcomes.
Predictive analytics	Assists in understanding the future and provides foresight by identifying patterns in historical data. What will happen? When and why?	Can be used to predict an accounts receivable balance and collection period for each customer and to develop models with indicators that prevent control failures.
Prescriptive analytics	Assists in identifying the best option to choose to achieve the desired outcome through optimization techniques and machine learning. What should we do?	Used in identifying actions to reduce the collection period of accounts receivable and to optimize the use of payables discounts.

Tschakert et. al. Journal of Accountancy 8/16

Applying Analytics Steps



Kogan et. al. CPA Journal 2/17

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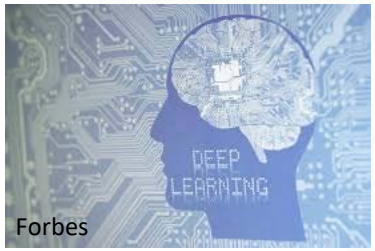
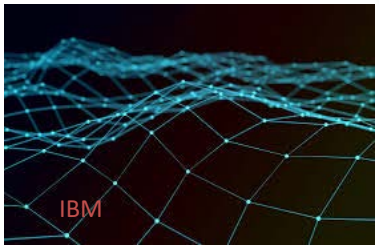
Emerging Approaches

- ***Predictive analytics***

- ***Deep learning***



- ***Blockchain/Smart contracts***



- ***Text mining***

Examples of Tools

- Visualization → Tableau

- Text mining → Python

- Basic Statistics → R

- Basic IT audit → ACL (now Galvanize)

Among technical skills, here's what is missing the most:
Identifying key data trends (29 percent)
Data mining and extraction (28 percent)
Operational analysis (28 percent)
Technological acumen (27 percent)
Statistical modeling and data analysis (27 percent)

The most significant gaps in nontechnical skills, or soft skills, are found in:
Decision analysis (37 percent)
Process improvement (35 percent)
Strategic thinking and execution (32 percent)
Adaptability to change (31 percent)
Communication skills (29 percent)

accountingweb 4/27/16

What is the current accounting profession environment?

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THE ACCOUNTING PROFESSION
CHANGING FAST

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CFO INNOVATION

Talent Management

Report Reveals Skills Required for Future Accountants

by CFO Innovation Staff | Apr 5, 2017 12:03pm

In today's volatile, uncertain, complex, and ambiguous workplace, accountants need to possess knowledge and skills across multiple disciplines. These include technological know-how, interpersonal and communication skills, critical thinking and creativity.

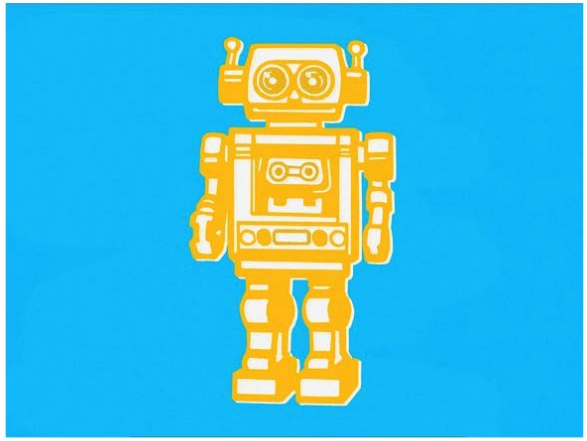
Longer and more structured internships, as well as apprenticeships are welcomed by the accountancy profession to enable accountancy students to understand real-world problems and determine where their passion lies.

These are some of the findings from a report produced by the Institute of Singapore Chartered Accountants (ISCA), and the Institute of Chartered Accountants in England and Wales (ICAEW), with the Singapore Management University (SMU) School of Accountancy coming on board as knowledge partner.

The report, entitled "Industry Perspectives: Future of Professional Learning and Entrepreneurship", is the second "Our Future Together" collaboration between ISCA and ICAEW, which aims to discuss how education, training and professional learning could be redefined to better develop and prepare professional accountants for the future economy.

VASANT DHAR BUSINESS 02.20.17 08:30 AM

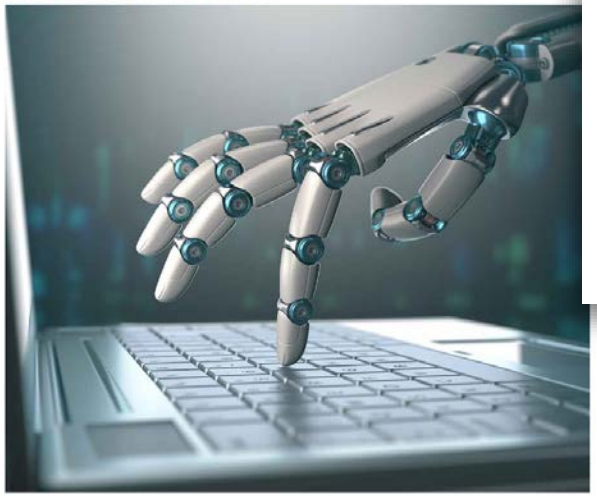
ROBOTS WILL SOON DO YOUR TAXES. BYE-BYE, ACCOUNTING JOBS



GETTY IMAGES

VIEWPOINT ROBOTS AND THE ACCOUNTANT

WILL ROBOTS REPLACE ACCOUNTANTS?



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Data Analytics and the Profession

ISCA Journal June 2017

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Paving the way to a new digital world

By Jeff Drew Journal of Accountancy June 1, 2018

- “The accounting profession is heading into the greatest period of change and disruption it has ever seen.”

- “The technology advances are going to come in two phases. In the first phase, technology will certainly enhance and enable much greater leveraging of data. Auditing will become data-driven, and the use of data analytics and artificial intelligence will change how historical financial statements are audited. In the second phase, the next question we will begin to ask is, "How valuable is the historical financial statement audit as technology continues to advance?" I fully believe that the assurance model for our profession — through the advances of technology — will ultimately transform to focus on the people, processes, and systems they are using. It's going to be an interesting transformation.”

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Continued

- Also in the three- to five-year range are two other issues. One is the expert use of analytics. We need to get closer to real-time reporting. Part of that's going to happen as a result of tools that provide us with predictive analysis, the ability to dig down deeper and not destroy the nature of the data we are working on. Second, we may not just be auditing financial data in the future. We may be auditing people's ability to handle issues. We may be handling total nonfinancial issues relative to a product's performance. So, whatever it might be, the markets are going to start looking for sources that can provide them with secure and trusted information and opinions. And if we do it right, I think the CPA profession can move five to 10 notches ahead of where we are even today. What are we going to need for that? We are going to need to look beyond the numbers. We are going to need to learn how to collaborate, and we need to think and behave more strategically.

THE FUTURE OF TECHNOLOGY AND ANALYTICS

Brad J. Monterio Strategic Finance *June 1, 2019*

- Legacy models and paradigms of how accountants “used to do things” are being disrupted by innovative new approaches, solutions, and processes. Make no mistake about it: Disruption in your profession is already here, and it’s going to continue. Some may see chaos or uncertainty; others will experience fear of what’s next; still others will see innovation, opportunity, and competitive advantage amidst the disruption.

- The disruptive changes mean that management accountants need to adapt or get left behind, figuratively speaking. This is meant to urge you to action. The profession must evolve its competencies and skills in order to get out ahead of the changes and best position itself to ride the wave crest into the future while remaining relevant and valuable.

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Merging accounting with ‘big data’ science

Jeff Drew Journal of Accountancy July 1, 2018

- “The need to collect, organize, and mine data for business insights — all in real time — will present the accounting profession with unprecedented challenges and opportunities in a rapidly approaching, radically different future.”
- “I (Anderson) have been working with the academic community to modify the accounting curriculums to embrace data analytics as well as the computer science piece of this equation... But I think it should be a core component of the accounting curriculum. It's very, very crucial to recognize that these are core fundamental skills needed on a go-forward basis…… CPAs don't need the expertise or skills in all areas, but they do need to have enough baseline understanding for effective teamwork. A firm that has a combination of technical and collaborative skills can leverage one another's strengths to help the CPA in his or her analysis and creation of insights that are communicated to the client ”

Goingconcern September 10, 2019

- “Increased demand for technology skills is shifting the accounting firm hiring model. This is leading to more non-accounting graduates being hired, particularly in the audit function,” said Barry Melancon, CPA, CGMA, AICPA president and CEO, and CEO of the Association of International Certified Professional Accountants. “CPAs have an unmatched reputation for trust and integrity, earned through decades of working in the public interest. However, to play this vital role in the future will require an increased focus on technology. It is incumbent upon the profession to ensure accounting graduates and newly licensed CPAs have these skills and expertise needed to support the evolution of the audit.”
- Overall CPA firms hired about 11 percent fewer accounting graduates in 2018 than they did in 2016, and nearly 30 percent fewer than in 2014. As firms continue to embrace technology and evolve their approach to the audit, they are seeking employees with data science and data analytics skills. They are largely filling those needs with non-accounting graduates, though there is anecdotal evidence from firms to suggest that some of this technology-specific hiring is occurring at the experienced hire level.

6 Ways IoT will improve accounting

Daniel Newman
Sage Advice June 5, 2018

No audits– ever

…imagine if your connected ledgers, journal entries, donations, and other transactions were tracked, sorted and verified on the spot, rather than months later. Blockchain is already starting to take advantage of this technology.

Optimize costs—and time

By knowing what and where your employees are, you can analyze their downtime, their most productive hours, and areas in which certain work might be best handed off to another, more productive employee

Track assets and inventory

By connecting devices to the IoT or equipping inventory with RFID chips, you'll know where they are at all times—whether they're in use—and who has them

By creating "smart" shelving or packaging, you can instantly find an accurate inventory of any item at any time.

Optimize performance—and satisfaction

Accounting departments would have a better idea of how to allocate budgets if they knew what was needing to be fixed. This also results in less downtime and high productivity and ultimately customer satisfaction.

Provide more accurate quotes

…with the IoT, historical analytics pulled from past jobs can help create an incredibly accurate quote, calculating how much manpower, machine use, and time you will need to get the job done well.

Keep employees healthier

Wearables can help you use this data to build a culture with happier and healthier employees, fewer sick days, and less turnover—all of which impact the bottom line.

Do accountants have the necessary data analytic skills to utilize these technologies and add value to organizations? Are accounting programs providing these skills?

BIG DATA in Business Analytics: Implications for the Audit Profession

Tang, Jiali (Jenna); Karim, Khondkar E.The CPA Journal; New York Vol. 87, Iss. 6, (Jun 2017): 34-39.

- …it seems that the application of big data on business practice has no limits. When companies start to conduct business and record accounting numbers in a way driven by big data, the audit profession must update its knowledge of big data.

- First, big data integration starts with the combination of traditional data and big data.

- The second element of big data integration is the talent training process. The end results of big data integration mostly depend on the competence of the people managing it.

- Meanwhile, the recruiting and training of future auditors already proficient with big data is a difficult task. Universities should design accounting courses with focus on data skills and encourage interactions between the accounting and computer fields.

Accounting Today August 14, 2019

The future of AI

As we look to the next phases of development for AI in tax and accounting and other knowledge-intensive fields, it is clear that the technology will follow a similar evolutionary path. The technology used today to surface meaningful insights from unstructured data sets is now being developed to actively monitor for anomalies and spot emerging risks. That capability will open the door to more advanced, predictive scenario planning and analytics, and, ultimately, automation of many of these capabilities.

AI skeptics will say that means job losses will not be far behind. But that narrow view of the world ignores the human capacity to do more things and evolve our capabilities along with technology. Very few knowledge workers today miss the good old days when they had to toggle through reams of microfiche to find old news articles or wait for a bike messenger to deliver important documents from a client. Throughout history, as technology has evolved, our capacity to do more with the time we've gained through increased efficiency has grown with it. That will continue in the AI future, opening up new levels of achievement that would have looked superhuman just a few years ago.

Khalid Al-Kofahi Vice president of research and development, Thomson Reuters

Professional reactions to the new data analytics environment

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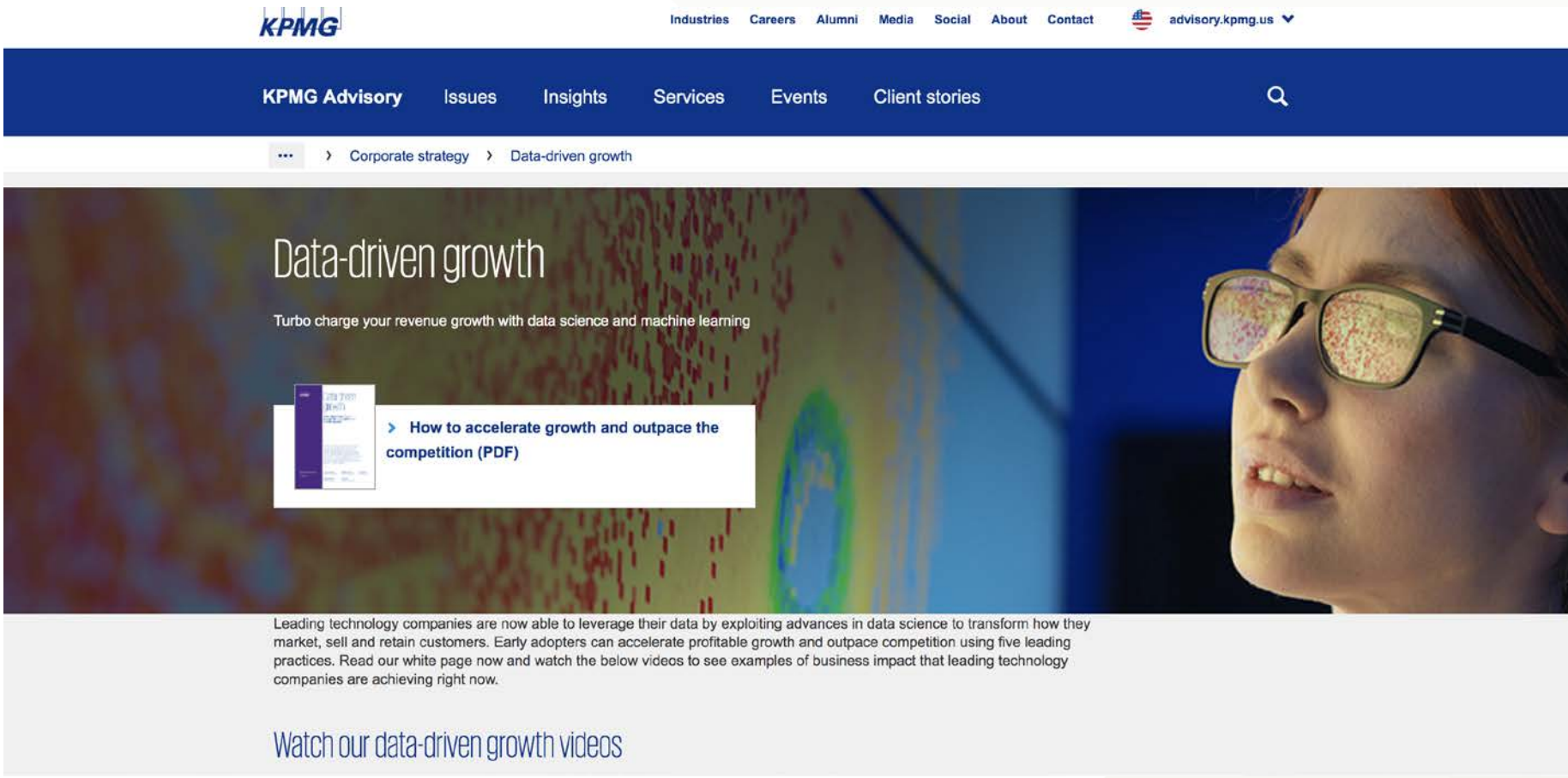
KPMG



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KPMG Curriculum for Specialized Masters

ADVANCED D&A CURRICULUM

The demanding coursework at participating universities will go beyond traditional accounting principles and tax regulations to include use of technologies and methodologies used in today's highly complex, data-centric accounting environment. Students will gain advanced skills through a combination of classroom and hands-on learning, utilizing KPMG's advanced proprietary tools and complex data sets.

- Each university has integrated KPMG's Program into its Master of Accounting or Master of Taxation degree for the required 30 hours of credit.
- The coursework includes subjects such as those listed below:
- Data Analysis and Visualization
- Systems for Data Analytics
- Auditing through Information Systems
- Probability, Uncertainty and Statistical Decision Making
- Auditing with Automated Audit Procedures
- Innovation, Emerging D&A and Cognitive Technologies
- The Future of Data and Analytics in the Tax Practice
- Data Mining for Business Intelligence
- Fraudulent Financial Reporting

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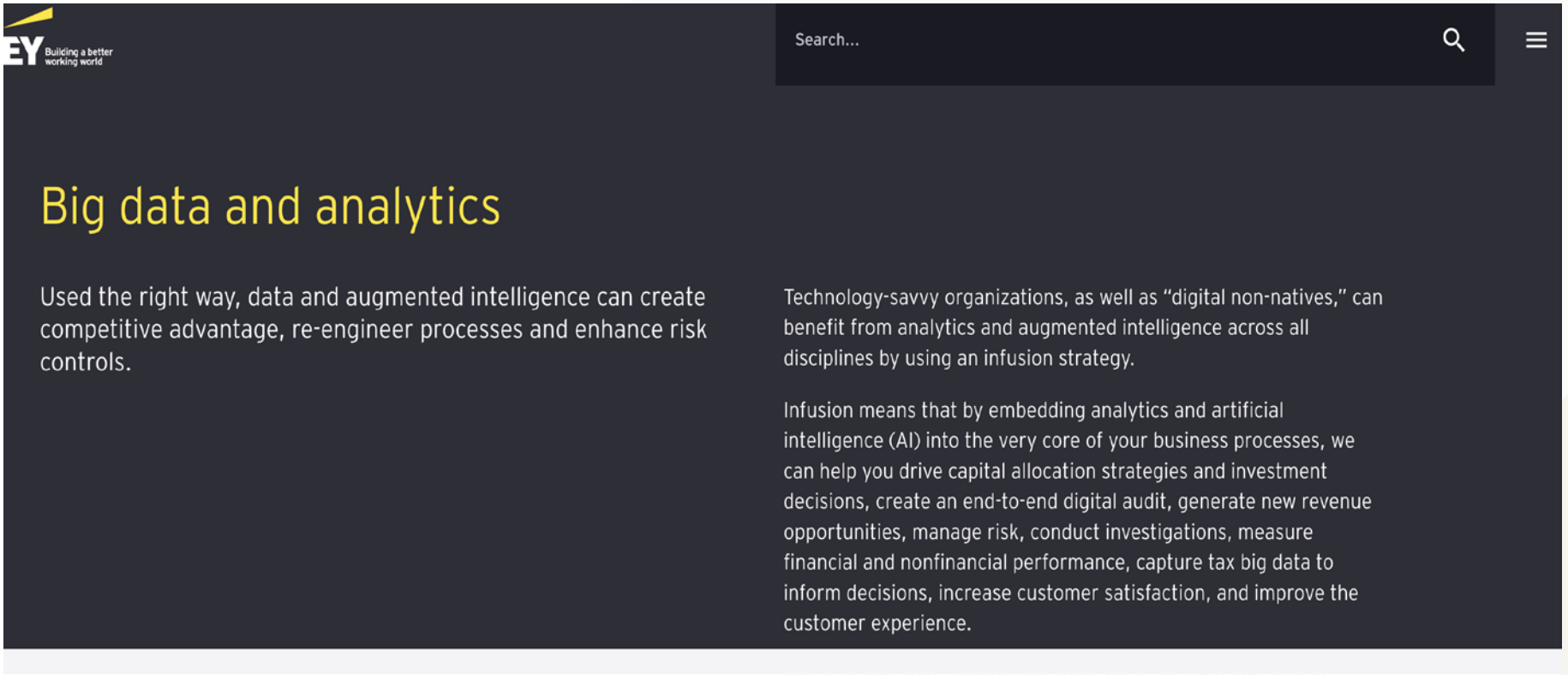
EY



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EY

- **The analytics mindset**
- Analytics is changing the role of the business professional by placing analytics at the heart of all business decisions. Therefore, students need to prepare for this changing role by developing an analytics mindset. What is this? **An analytics mindset is the ability to: ask the right questions; extract, transform and load relevant data (i.e., the ETL process); apply appropriate data analytics techniques; and interpret and share results with stakeholders**. We offer a module that covers the introduction to the analytics mindset and a competency framework that outlines the competencies that support this mindset (a competency framework). We also offer a variety of presentations and cases as well that align with this framework to help develop these competencies in the classroom.

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Is your organization leveraging data to drive growth?

Doug Thomas Managed Services Leader, PwC US

Data is the new gold. Managing data proficiently is one way to keep companies running successfully, enabling business executives to make the insight-driven decisions needed to achieve a company's growth goals.

According to the most recent PwC CEO survey, 91% of US CEOs are confident that their companies will grow organically in the next 12 months. The question is, which businesses worldwide will win the battle for market share and growth? The answer? Companies with the lowest cost, best value, and optimal data management.

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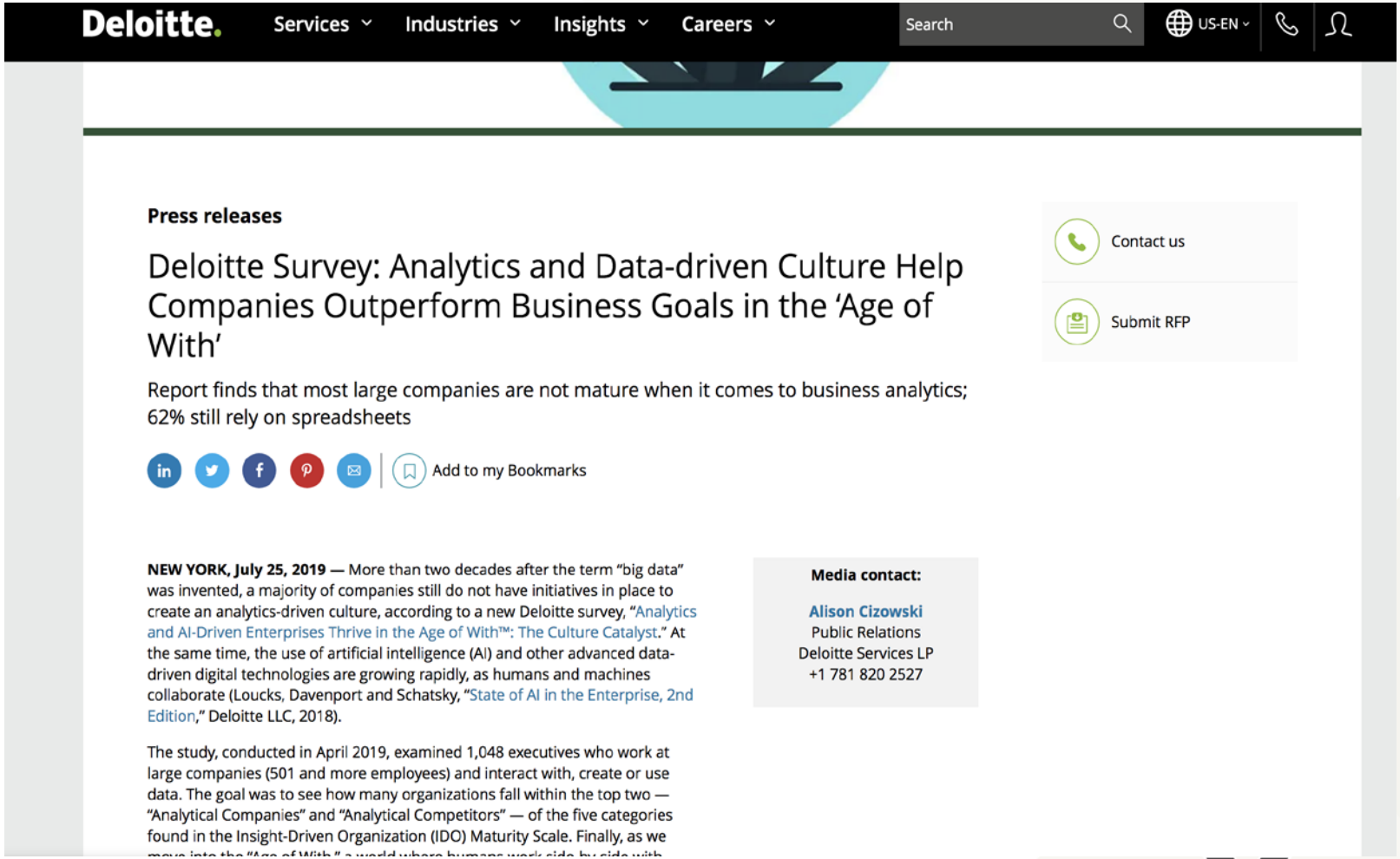
Deloitte



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Associate Chartered Accountant Qualification

New ICAEW chartered accountants to learn data analytics, take modified exams

THU, SEP 05, 2019 - 4:57 PM

FIONA LAM fiolam@sph.com.sg @FionaLamBT

THE Institute of Chartered Accountants in England and Wales (ICAEW) is refreshing its Associate Chartered Accountant (ACA) qualification by introducing emerging technologies into the curriculum.

Starting from 2021, ICAEW will incorporate the use of Inflo, a financial data analytics software, in examinations for two modules of the qualification: audit and assurance as well as corporate reporting.

It will be introduced first with the audit and assurance exam in March that year, followed by the corporate reporting exam in June. The new approach will be reflected in the 2021 learning materials which will be published in September 2020.

The Inflo software may potentially be extended to other modules across the ACA syllabus in the future.

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AICPA/NASBA

The Request for Input is the latest step in a professionwide consideration of what changes may be needed in the CPA licensure model. **Artificial intelligence (AI), automation, and data analytics have created opportunities for CPAs to provide new services and deliver their services in new way**s. Meanwhile, companies increasingly need services in areas such as IT risks and controls, business intelligence, and cybersecurity risk management.

- Newly licensed **CPAs need skills and knowledge in areas such as**:
- Business intelligence.
- Data management, analysis, and reporting.
- Predictive analytics.
- Cybersecurity risk management.
- IT risks, controls, and assurance.
- Information security governance.
- Last year, NASBA and the AICPA formed a working group to consider possible changes to licensure. The group recommended that education and exam requirements need to evolve to address the increased demand for technological and analytical expertise.

Journal of Accountancy June 12, 2019

AICPA

The Examinations team is following its typical rigorous process for the current practice analysis. Meetings were held with about 20 firms of varying sizes to discuss the knowledge and skills essential for newly licensed CPAs and the impact of technology on their work. CPAs who supervise newly licensed CPAs in public accounting as well as in business and industry have been participating.

They learned that:

- Critical-thinking and problem-solving skills, which were emphasized in the 2017 exam refresh, remain extremely important.
- CPA candidates often need a more comprehensive understanding of business processes, information systems related to financial reporting, and how business works.
- **Data analytics and a digital mindset is a high-demand area.**
- Excel skills are essential.
- Companies and firms are relying more on System and Organization Controls (SOC) reports, and understanding how to use these reports is increasingly important for newly licensed CPAs.

IMA

- https://www.imanet.org/education-center/tech-and-analytics-center?ssopc=1

ima — 100 years — The Association of Accountants and Financial Professionals in Business

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Technology & Analytics Center

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Empowering You with Technology & Analytics

Welcome to IMA's center for educational resources focused on key technology and data analytic trends affecting the accounting and finance profession. From webinars to research, IMA is dedicated to providing a relevant and robust portfolio of resources to better serve your technology needs.

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IS THE ACCOUNTING ACADEMY SUFFICIENTLY AGILE AND TIMELY?

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HOW IS THE ACCOUNTING ACADEMY RESPONDING IN TERMS OF THEIR RESEARCH, TEACHING AND ENGAGEMENT?

Pincus, K. V., et al. "Forces for change in higher education and implications for the accounting academy."

Journal of Accounting Education (2017)

that these forces (financial and technology) are significant enough to demand the attention of, and thoughtful responses by, accounting educators."

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RESEARCH RELEVANCE TASK FORCE:

AAA President, David Burgstahler assigned a committee in 2017 and it published a report 2018

Available on the AAA website

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RESEARCH RELEVANCE TASK FORCE FINDINGS

Problem 1: Accounting academics often find it **difficult to interact with people in practice** and as a consequence they are **not aware of**:

a. **Interesting questions** faced by practitioners that would provide useful insights if investigated.

b. **Innovations** in practice that could be the foundation for future academic research and for enhancing student knowledge of contemporary best practices.

Problem 2: Accounting academics are **not rewarded for conducting research that informs and influences practice.** They are rewarded for publishing their research in top tier journals.

Problem 3: Accounting research is not widely read and accounting has a "bad public image." The **public in general does not understand the scope and importance of the field**. Even when our research has practical implications it may have no impact on practice.

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ARE WE BEING DELIBERATE IN OUR STRATEGY GOING FORWARD?

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What is our Future?

- Where do we want to go?
  - Teaching, research, service
  - CPA licensing

- How do we get there?
  - Change management
  - Curriculum revision--constant

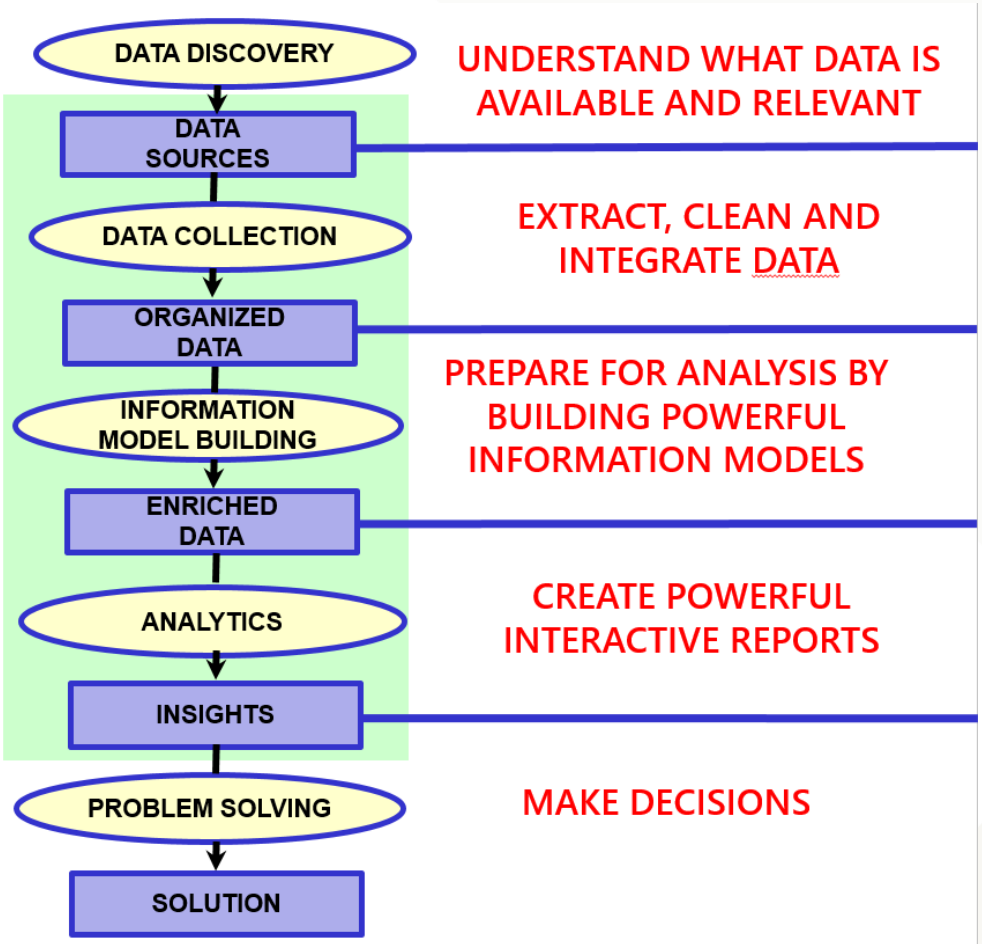
Impact on How We Teach

- But digital transformation isn't just changing *what* we teach—it's changing *how* we teach. Schools are offering online, hybrid, and MOOC courses; they're enabling students to work in virtual teams, both across colleges and across universities. They are providing students with learning environments that are patterned after evolving office environments so that graduates will be comfortable in the workplace of the future.
- I've heard people say that a student from 75 years ago could be dropped into one of today's classrooms and find it familiar, because there would still be a sage on the stage lecturing to a group of people. While that might be true some of the time, it's not the only truth. Our classrooms have changed to match the changing workplace.

John Elliott—current AACSB Board Chair

Guido Geerts Syllabus—University of Delaware

Data Process Chain



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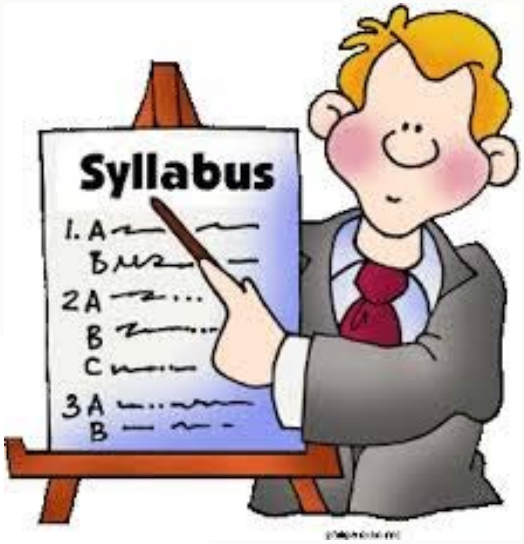
Geerts Syllabus Topics continued

- Introduction to Big Data
- Introduction to Power BI:
  - Data Visualization
  - Data Analysis
  - Extraction
- Data Analytics in Accounting Practice
- Information Modeling
- Analyzing Accounting Data
- Profiling and Transforming Accounting Data
- Advanced Accounting Applications



Ann Dzuranin, Northern Illinois University

- Introduction to Data and Analytics in Accounting (1 session)
- Critical Thinking Framework (1)
- Asking the right questions (1)
- Understanding Data: types, storage, extraction methods (2)
- Understanding Data: Exploratory Data Visualization (3)
- Descriptive Statistics (2)
- Trendlines and Regression (4)
- Applying DA in Accounting (8)
- Emerging Technologies: Robotic Process Automation (RPA) (4)

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The **University of Illinois-Deloitte Foundation Center for Business Analytics** is now releasing the **Second Course in Foundations of Data Analytics** as well as **five mini-case studies**. This second course – similar to the first – is free, online, and accessible to anyone who wants to leverage it for their educational mission.

Second Course in Foundations of Data Analytics

The Second Course in Foundations of Data Analytics will build a practical foundation for machine learning by teaching students basic tools and techniques that can scale to large computational systems and massive data sets. Topics include algorithms, overfitting and regularization, clustering, anomaly detection, and more.

Module #1: Introduction to Machine Learning
Module #2: Fundamental Algorithms
Module #3: Practical Concepts in Machine Learning
Module #4: Overfitting and Regularization
Module #5: Fundamental Probabilistic Algorithms
Module #6: Feature Engineering
Module #7: Introduction to Clustering
Module #8: Introduction to Anomaly Detection

Each of eight modules consists of multiple lessons, which each contain a video explaining the lesson content, external reading(s), and included course Jupyter notebooks. Each module also includes a quiz (or assessment) that tests basic mastery of the lesson contents, and a programming assignment that tests synthesis of the lesson contents. **Click here** or complete the **brief registration form** to access the Second Course in Foundations of Data Analytics.

Mini-Case Studies

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Teaching Resources—Constant Change

- Accounting Horizons June 2015—9 articles
- AH September 2015 commentary
  - **Infer, Predict, and Assure: Accounting Opportunities in Data Analytics**
    - Gary P. Schneider, Jun Dai, Diane J. Janvrin, Kemi Ajayi and Robyn L. Raschke
- Journal of Accounting Education March 2017– 7 articles and cases
- Journal of Information Systems Fall 2017—4 articles / commentary

- Data analytics can be a prime example of research and profession converging to meet mission of accounting

AAA sample workshop:

https://aaahq.org/Meetings/2019/SummerWorkshop2019

- The workshop is the place for:
  - Faculty to focus their teaching and research talents on the why and how-tos of data and analytics.
  - Program leaders to focus on curricula innovation and their agility to meet the needs of an accounting profession transformed.
  - Whether you are faculty at the forefront or just beginning, there's something for you! Be prepared to thrive!

- Prepare to Integrate D&A into Your Courses and Programs:
  - Robotic Process Automation (RPA) using Automation Anywhere or UiPath.
  - Data Cleansing (ETL) using Alteryx, Power BI, Tableau Prep.
  - Data Visualization and Analytics using Tableau, Power BI, SAP Analytics Cloud.
  - Hands-on with Python and R.
  - Audit and Fraud Tools i.e., Mindbridge AI, IDEA.
  - Blockchain Use Cases and Simulations.

Courses

- …here's a list of some of the course types they can consider when preparing for a career in the audit and assurance space:
- **1. Data science courses. ..** accounting majors should seriously consider taking courses that delve deeper into frameworks that map audit objectives to innovation and automated data analytic procedures.
- **2. Courses in artificial intelligence and cognitive learning.** Building experience through the use of innovative tools and platforms can help auditors increase the efficiency and quality of audits by enabling them to focus on high-risk areas and reduce error-prone, manual tasks
- **3. Advanced risk management modules.** Auditors will need to bring critical and creative thinking to the risk analysis and assessment process and apply cognitive technology to gain a deeper understanding of risks and how to develop audit procedures that are responsive. They will have to be well-versed in telling data-rich stories and more equipped than ever before to provide clients with valuable insights to consider.
- **4. Blockchain courses.** According to a report released in 2017 by the American Institute of CPAs and the Chartered Professional Accountants of Canada, blockchain actually makes it necessary for auditors to become comfortable with a whole new set of risks, such as more complex forms of fraud, and thus may significantly change how auditors do their jobs. There is an increasing adoption of blockchain by businesses, and many accounting firms have undertaken blockchain initiatives to further understand the implications of this important and versatile technology.
- **5. "Soft" skill courses, such as ethics of emerging business technologies.** Some already see it as a business imperative that auditors become more comfortable with words, feelings and debate in addition to becoming competent when it comes to numbers-based activities.
- **Erin Shannon Audit & assurance managing director and strategic initiatives leader, Deloitte & Touche LLP. AccountingToday, August 29, 2019**

Education Choices

- Curriculum
  - Accounting, non-accounting business, non-business, some combination
- Integration into courses, stand alone course, wither or both?
- Continual change and updating
  - Process
  - Resou

Data Analytics Research

- **Eight Issues on Audit Data Analytics We Would Like Researched**
  - Journal of Information Systems Spring 2015
  - Tawei Wang Robert Cuthbertson
- **Big Data and Analytics in the Modern Audit Engagement: Research Needs**
  - Auditing: A Journal of Practice and Theory November 2017
  - Deniz Appelbaum Alexander Kogan Miklos A. Vasarhelyi
- **Finding Needles in a Haystack: Using Data Analytics to Improve Fraud Prediction.**
  - The Accounting Review: March 2017,
  - Johan L. Perols, Robert M. Bowen, Carsten Zimmermann, and Basamba Samba
- **Bid Data Opportunities for Accounting and Finance Practice and Research**
  - Australian **Accounting** Review, 2018
  - S. Cockcroft, M Russell
- **Big Data Techniques in Auditing Research and Practice: Current Trends and Future Opportunities**
  - Journal of Accounting Literature, June 2018
  - A Gepp, MK Linnenluecke, TJ O'Neill

Accounting Horizons Vol. 33, No. 3, September 1, 2019

Data Analytics Forum

Audit Data Analytics Research—An Application of Design Science Methodology

A Machine Learning-Based Peer Selection Method with Financial Ratios

Applying Deep Learning to Audit Procedures: An Illustrative Framework

Contract Analytics in Auditing

Multidimensional Audit Data Selection (MADS): A Framework for Using Data Analytics in the Audit Data Selection Process

Process Mining of Event Logs: A Case Study Evaluating Internal Control Effectiveness

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Accounting Horizons Conference on Data Analytics in Accounting

Dec 12-13, 2019, New York City

This two-day conference, co-sponsored by Accounting Horizons and the Stan Ross Department of Accountancy at Baruch College, features concurrent academic presentations, two keynote speakers, and a panel discussion on data analytics research in accounting and auditing.

A complete program is available here: https://zicklin.baruch.cuny.edu/event/accounting-horizons-conference-on-data-analytics-in-accounting/

Data Analytics and the Role of the Accountant
- Data Analytics Knowledge Required of CPA: A Normative Position

Accountant as Digital Innovator: Roles and Competencies in the Age of Automation
- Using Machine Learning in Accounting Prediction
- Predicting Accounting Misstatements Using Machine Learning
- Predict Audit Quality Using Machine Learning Algorithms

Emerging Issues in Data Analytics
- The Audit Implications of Cloud Computing
- Data Analytics in Cybersecurity Assurance: Should Data Analytics be an Integral Part of Cybersecurity?

Data Analytics in Auditing
- Stakeholder Perceptions of Data and Analytics Based Auditing Techniques
- An Exploratory Study into the Use of Audit Data Analytics on Audit Engagements

Panel Discussion: How Will Data Analytics Change Accounting Practice?

Predicting Earnings and Returns with Machine Learning
- Machine Learning Algorithms to Predict Returns Using Structured and Unstructured Data
- Improving Earnings Predictions with Machine Learning

"Roadblocks" in Data Analytics in Accounting
- A Potential Unintended Consequence of "Big Data": Does Information Structure Lead to Suboptimal Auditor Judgment and Decision-Making?
- Investigating Accountants' Resistance to the Adoption of Data Analytics Technology

Data Analytics and Disclosure
- Shareholder Wealth Effects of Audit Data Analytics Announcements
- Transfer Learnings and Textual Analysis of Accounting Disclosures: Applying Big Data Methods to Small(er) Data Sets

Data Analytics in Managerial Accounting
- The Attenuating Effect of Intelligent Agents and Agent Autonomy on Managers' Ability to Diffuse Responsibility
- Blockchain Technology, Inter-Organizational Relationships and Management Accounting: A Synthesis and a Research Agenda

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HOW DO WE MAKE NEEDED CHANGES?

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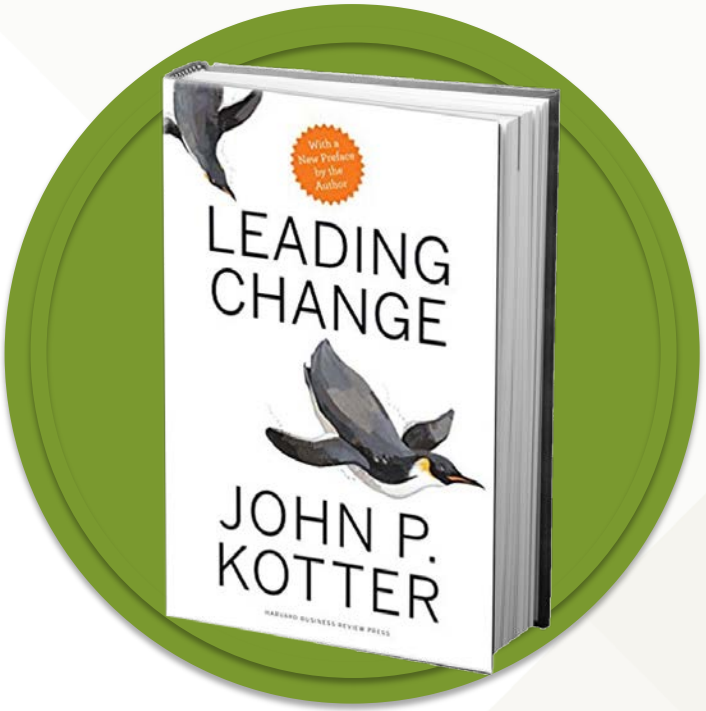
NEED FOR A PLAN FOR CHANGE?

ONE EXAMPLE:



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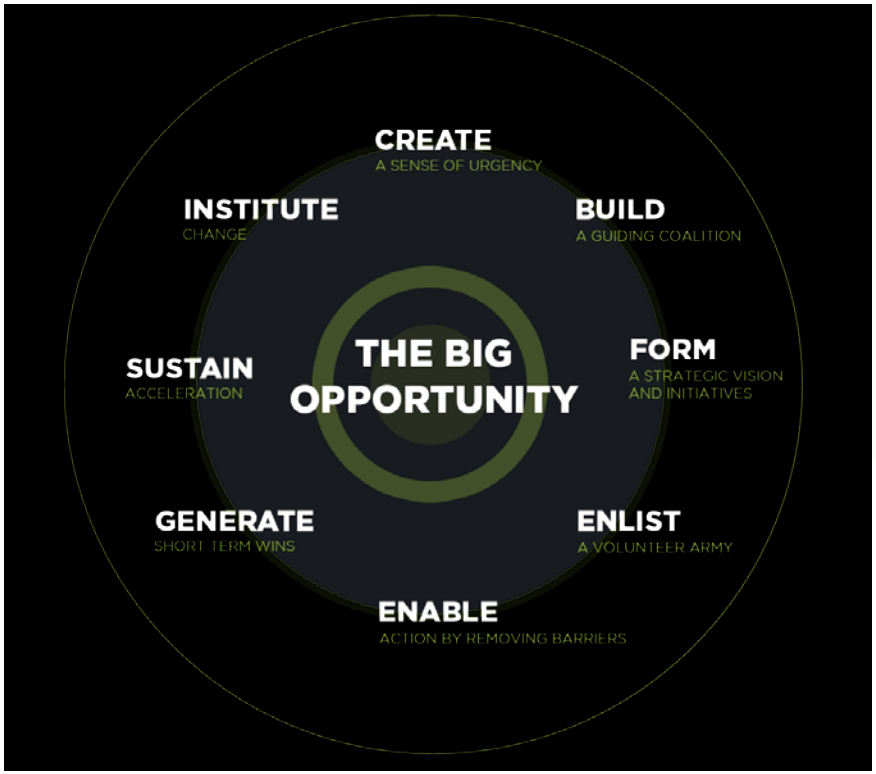

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Accountants need to have data analytic skills

It is best to have a plan and be deliberate

Consider a combination of stand alone courses and integration into existing courses

Conduct impactful research

Are we leading or lagging?

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Questions?

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Thank You For This Opportunity

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