Chapter

Management Accounting Practices and E-Business Model in the US Walmart Corporation

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Abstract

This study aims to explain management accounting practices and E-Business model in the US Walmart Corporation. This study uses qualitative methods and websites methodologies underpinning the interpretive approach to explain a detailed case study in the United States. This study found that Walmart uses a management accounting system for efficient store planning, controlling, and other management-related activities to enhance organizational effectiveness and performance. The diffusion of managerial accounting information is very important for the budgeting process and costing of all departments. The efficiency of an accounting system is crucial for the performance and sustainability of Walmart's business. This study can be considered one of the few studies examining the management accounting practices in the United States case study, Walmart Corporation. Integrating E-business technology with accounting practices and other organizational domains is excellent evidence for the 21st Century Approaches to Management and Accounting literature.

Keywords: Management Accounting Practices, E-Business Model, Walmart, United States

1. Introduction

Walmart is one of the world's largest global retailers, operating discounted, departmental, and warehouse stores across various jurisdictions. Walmart stores have been grown rapidly as they become very popular as a retail giant. In 2017, the total number of stores had 11,695 stores, of which 5,332 were located in the United States, and 6,363 were located overseas. The majority of Walmart stores outside the US are placed in Mexico as it has 2,411 Stores. Besides, the UK had 631, Canada 410, and Brazil 498 Walmart stores operated in 2017 [1]. Walmart has also increased its existence in China, where there were 439 stores in 2017. The Asian economy is proliferating, making China and India significant markets for Walmart (*ibid.*).

As a retail corporation, Walmart collects information on its stores, sales, and purchases through a centralized accounting information system connected to all stores. The system contains the details of daily transactions from every store. Walmart's Accounting System enables the company to make accurate projections of its stores' financial sales and purchases. This factor aids the company's decision-making process at the operational level [2]. The paper analyzes Walmart's management accounting system by discussing its inventory control and accounting practices, including its

budgeting, costing, and capital decision making as presented in the capital structure to establish the strengths and weaknesses of its accounting system.

Gilbertson and Lehman [3] noted that Walmart has, specifically, installed the vision-suite accounting management software, composed of different financial management functions that include the general ledger, financial reporting, and integration of external accounting systems. Vision suite software automatically generates accounting documents for use within the company's accounting system. This helps the management access vital reports used in the decision-making process [4, 5]. Gilbertson and Lehman [3] observed that the main limitation to the vision suite software is its vulnerability to hacking and computer viruses. This means that gaps in control and security mechanisms could affect the company's financial information confidentiality. Such risks affect the reliability of an accounting system and its ability to ensure operational efficiency.

This chapter is divided after the introduction as follows. Section 2 presents the literature review. Section 3 provides the research methodology and US case study. Section 4 explains the analysis and discussion of the chapter, and Section 5 introduces the SWOT analysis of Walmart's business. The final section is the main conclusions and recommendations.

2. Literature review

Contemporary accounting studies have shed light on how accounting is practiced in social activities and arrangements [6–13]. Walmart's retail business has no exception as 'the social, or the environment passes through accounting. Conversely, accounting ramifies, extends and shapes the social' [14, 15]. One of the management accounting practices that can influence social activities is operating cost or overhead cost. According to Alsharari [16], there is no problem if all cost items could be directly traced to each cost center, so accurately calculating the product cost and profitability would be very easy. However, overhead costs are becoming prominent, and these might arrive at more than half of total manufacturing costs.

On the contrary, Walmart has reduced its operating expenses or overhead costs through implementing an advanced accounting information system, including management accounting practices. Walmart uses online accounting systems and software programs to automate business and accounting functions, online grocery, payments and receipts, and virtual communication. Advance accounting information systems led to the high efficiency of Walmart assets. This helped Walmart to reduce the operating costs to satisfy the social arrangements. Walmart has lowered the highest overhead expenses in labor costs as they can only get the minimum wages consistent with local laws.

2.1 Management accounting practices

Management accounting practices are systems that enable firms to generate information for budgeting, reporting and controlling, measuring performance, and costing products and services that in turn assists in managerial decision making [8, 17–19]. Management accounting information systems are structured differently across organizations and employ different techniques for collecting, processing, storing, and reporting financial information, in tandem with the agency theory. The significance of accounting systems has grown with increases in consumer demands, market competition, and market unpredictability, where proven scientific methods and reliable data is a prerequisite for managerial decision-making [20]. The significant new approaches that are relevant to management accounting systems;

include the Just in Time (JIT) for inventory management, overhead costs management, capital budgeting techniques, and Activity Based Costing (ABC) method [14, 15, 21–25].

JIT is an inventory management technique where goods within the supply chain innovation are produced or delivered on a need or demand basis. JIT inventory management measures consist of stock-out rate, inventory turnover, and storage costs. According to Agrawal and Smith [26], inventory management reflects the average time inventory is sold out and refilled. The key objective of this technique is to ensure the constant supply of goods while minimizing inventories and storage costs [27]. On the other hand, the ABC system allows for the accurate costing of goods to enhance decision-making. In the ABC system, major products classified as category A items in the inventory are outputs sold in stores, supported by an effective accounting information system at the supply chain and inventory management [16, 28, 29]. Alternatively, the category B items symbolize other materials used to support operations, such as maintenance and office equipment. Finally, the last category of C items reflects the minimum monitored and registered inventory items, just like toiletries and other materials [26].

Walmart has reduced the operating and overhead costs and the costing system, but the burden was on the employees and suppliers. It has changed different accounting practices in response to external pressures, and several improvements have been emerged to improve its image in the market and among its customers. At the same time, it has also increased the hourly labor rate with a new work atmosphere. At the center of Walmart's business model is cost leadership. Walmart's brand has controlled the US retail market through reduced costs [30]. Accordingly, Walmart uses its strategy to achieve a competitive advantage based on low overhead costs and correspondingly low selling prices. Porter's [31] model shows that the organization effectively uses a competitive system to compete against other organizations in the same industry. In the case of Walmart, the competitive advantage is maintained through various accounting strategies and practices. Although the entire system used in Walmart's business depends on reducing overhead costs, this strategy enables Walmart to change its selling prices accordingly. In this regard, selling price reduction is a strength that helps Walmart compete against other organizations operating in the retail market.

2.2 Walmart's business model, business strategy, and competitive advantage

Brea-Solis *et al.* [32] defined a business model as a description of how an organization works, stating how the organization creates value for consumers and harnesses part of the value as profit. Walmart's complex accounting system, which integrates all its stores and business channels, reflects its Omni-channel business operation model. The Omni-channel retail model relates to a business framework based on the retailer's need to provide goods and services and communicate with consumers seamlessly across multiple business channels. These channels may include physical stores, websites, mobile applications, call centers, and so on. The Omnichannel retailing model is founded on the pressure to meet the consumer's need for convenience and availability in the backdrop of market competition. Many retailers are increasing their business channels by incorporating online stores, mobile channels, or opening physical stores to improve their market presence and availability [33, 34].

Brea-Solis *et al.* [32] noted that two main components operationalize a business model: the first one is leadership choices, and the second is related to policy choices. Leadership choices are usually relying on policies, corporate assets, and corporate governance. Ulrich et al. [35] described the policy choices as a strategy that each organization should develop for each part of its operations. The asset choices

comprise tangible resources such as manufacturing assets, satellite communication systems between offices, or using a specific airline. For instance, where the choice element revolves around a company's use of trucks, the governance choice is to lease or own a fleet. Making decisions in such scenarios has consequences on the firm that mainly affect its competitive advantage. Bromiley and Rau [2] noted that governance choices at Walmart incorporate the organizational structure employed to develop contractual plans.

Business strategy is defined as a contingent action plan through which a given objective is realized through the use of a set of activities that focus on uniqueness and valuable positioning [32]. Contrary to a business model, an activity system, a strategy dwells more on how the system is created. A strategy determines the business model used, the logic and manner in which a firm operates, and the way through which value is created. Walmart thrives on the strategies of differentiation, cost leadership, and technology to achieve a competitive advantage. The use of technology in demand forecasting and inventory management has been crucial in boosting the company's competitiveness [36]. Brea-Solis *et al.*, [32] framework bridges the industrial organization and resource-based approach to competitive advantage. Gagnon [37] noted that firms are more profitable to adopt the resource-based approach to operations strategy. In the current market in which the competition is high, product market positioning is an unsustainable strategy, and firms should, instead, develop and leverage their essential resources and abilities to realize long-term profitability [38, 39].

The emphasis of Walmart is currently on creating a unified accounting practice for its customers whether they are shopping online or physically at the stores. Walmart contributes highly to the global economy as it hires around 2.2 million employees, of which 1.5 million are inside the US. This discussion of Walmart's E-business model and business strategy shows how it has helped them achieve a completive advantage and strong growth [30].

3. US case study: Walmart corporation and research methodology

This study uses qualitative research and depends on the online and website methodological underpinnings. The case study, Walmart, adopted in this study has limited previous literature and database. This study has collected all essential data from the Walmart database, websites, Walmart annual reports, accounting data, and secondary data. A systematic literature analysis was conducted to collect data and develop an understanding of management accounting practices in Walmart. The analysis was made within the limits of a case study where the data collection and analysis were narrowed down to the example of Walmart's accounting management, budgeting, inventory cost measurement system, and capital structure [40]. The SWOT analysis has been introduced in this study to consider as a basis for future research and decision-makers.

Walmart is the largest US-based retailer among the physical retail brands in the US. It was founded in 1962 initially at Rogers, Arkansas, US. Since 2021, Walmart has owned more than 11400 stores; and it has served more than 240 million customers each week at different retail stores and e-commerce websites under 54 banners in 26 international regions. Walmart employs more than two million people who are named as Walmart associates. Walmart is not just a brick-and-mortar company. Over the last decade, it has invested in e-commerce and made acquisitions to grow its e-commerce capabilities. By 2020, it will have earned about $36 billion from e-commerce[1].

[1] Source: Walmart Revenue from Domestic and International Market - Statistic.

Walmart drives different businesses, retail, wholesale and other stories in the US, Canada, UK, Japan, Africa, Argentina, Brazil, Central America, Chile, China, India, and Mexico. It builds its business in three popular segments: Walmart US, Walmart International, and Sam's Club. The prevalent of these segments is Walmart US, with operations in all 50 states in the U.S., Washington DC, and Puerto Rico. Walmart International has functions in 27 international regions outside the USA. Sam's club is a group of warehouse store clubs with a membership.

4. The analysis and discussion

4.1 Walmart's corporate structure and culture

Walmart's organizational structure regulates the company's business activities. These activities are largely in the retail industry, comprising operations in the e-commerce market and online accounting. The corporate structure determines how the business addresses corporate problems. It helps to facilitate the corporate strategy implementation in capturing a retail market share. Walmart's organizational culture regulates the way of doing that the people respond to challenges in work. The flexibility of Walmart's human resources comparatively depends on the mindset reinforced by the corporate culture. Cultural qualities aid the retail business adapt to changes and emerging changes in the international market based on IFRS [41]. The history of Walmart displays that the corporate structure and culture support to bring competitive advantages and success. Walmart's structure interrelates with the corporate culture to sustain the major competitive advantage against other competitors, such as Amazon, Kroger, Apple, Google, and other technology corporations, with the same online digital content of the distribution operations[2].

Walmart takes a leadership position in the retail industry. Such position and long-term success are connected with the valuable combination of the corporate structure and culture. The qualities and implications of Walmart culture are affected by how the corporate accounting system supports HR development and other parts of Walmart's business operations, for instance, supply chain, accounting practices, marketing, and business strategy.

Walmart has a hierarchical functional corporate structure. This structure has two sides: hierarchy and function. The hierarchy side relates to the vertical lines of authority among the corporate structure. On the other side, the function feature involves groups of employees achieving positive functions. The key influence of Walmart's structure is the ability of Walmart managers to inspire the whole corporation.

On the other hand, Walmart's culture has four key elements. These elements direct Walmart's staff behaviors, which govern managerial capacities to add value in delivering the services to customers. The cultural elements as influenced by Walmart's structure can include: (1) service to customers; (2) respect for the individual; (3) strive for excellence; and (4) action with integrity.

4.2 Walmart's accounting system

An effective accounting system used by Walmart highlights a combination of accounting information and digital accounting that includes past performance, future information, actual risks, costs, and prices. Walmart also uses cost–benefit

[2] Source: Walmart: Organizational Structure & Organizational Culture - Panmure Institute.

analysis, IRR, and NPV to evaluate the feasibility of any project or region. Walmart continually evaluates its investment appraisal methods to make better capital decisions through the combination of financial and strategic project elements. Capital investment decisions rely on economic features that include income growth, returns on investment, global expansion, and profitability [42].

Walmart recently used a new accounting system to develop accounting practices for traditional and online customers. It has changed the framework to value inventory using the retail inventory accounting structure. The new accounting system has focused on cloud computing options and online accounting for different areas, such as costing, budgeting, inventory management, and management accounting.

Walmart's accounting system focuses on inventory and cost management, used to measure its liquidity and profitability. Walmart uses different costing methods in order to reduce inventory costs and providing accurate product costs. These costing methods are "Last In First Out" (LIFO) and "First In First Out" (FIFO). Walmart's annual report [43] shows how the company uses LIFO to calculate the average weighting cost for US products. However, it uses FIFO on the other side at international operations inventories [44, 45]. Walmart uses retail accounting to evaluate sales at low cost or market value [46]. This is necessary to reinforce the operation's effectiveness and competitive advantage. Walmart's leadership uses the ABC system to realize the total cost view; therefore, the ability to reduce overhead costs by eliminating cost determinants.

According to Brigham and Daves [47], Walmart uses capital budgeting techniques, which comprise 'discounted cash flow' (DCF), NPV and IRR methodology to evaluate different global investments and opportunities [48, 49].

4.3 Walmart's competitive advantage and business model

Walmart's competitive advantage is located in different factors, but the leading driver is pricing strategy. This strategy draws customers from the lower-income and middle-income segments in huge numbers. Besides, Walmart's supply chain strategy has also facilitated prices reduction. The corporation sources buy directly from the producers. Since Walmart buys in bulk, the producers sell their products at lower prices to Walmart, and in turn, Walmart sells its products at lower prices than other competitors. Walmart has continued a large fleet of trucks in the US market. Managing its logistics has enabled Walmart to control operating expenses and save cash. Since its establishment, Walmart adopted cost-saving accounting practices and continued to develop these practices. Consequently, its competitive advantage has continued to build up over time[3].

Walmart's general strategy is cost leadership. Porter's model describes cost leadership as a general competitive strategy that focuses on attaining low costs. Walmart as a low-cost producer of retail products, compete with others in the retail market. Low prices are the major strategic objective used in Walmart's pricing strategy and key selling target of the retail business. Walmart uses different approaches to continue low costs and, therefore, low prices. As Walmart continues to automate its technologies and minimize HR spending, they achieve low costs in operations[4]. Cost leadership comprises low product differentiation. With a focus on low prices as a selling point, Walmart's services and products are standard and, therefore, poorly differentiated from retail services from other companies in the market.

[3] Source: Business Model of Costco Versus Walmart - Statistic.

[4] Source: Walmart's Generic Competitive Strategy and Intensive Growth Strategies - Panmore Institute.

Year	US operations (Mil)	Non US operations (Mil)	Total (Mil)
2021	$436,649	$122,502	$559,151
2020	$402,532	$121,432	$523,964
2019	$392,265	$122,140	$514,405
2018	$380,580	$119,763	$500,343
2017	$367,784	$118,089	$485,873
2016	$357,559	$124,571	$482,130
2015	$348,227	$137,424	$485,651
2014	$338,681	$137,613	$476,294
2013	$332,788	$135,863	$468,651
2012	$319,800	$126,709	$446,509
2011	$311,591	$110,258	$421,849

Table 1.
Walmart's domestic and the international revenues over time. Source is: Retrieved from: https://www.macrotrends.net/stocks/charts/WMT/walmart/revenue.

4.4 Walmart revenues from domestic and international operations 2011–2021

Walmart was started in Delaware in 1969. It extended its international operations in 1991. E-commerce initiative was first introduced in 2000 and was extended internationally among 27 countries by 2020. The following table shows Walmart's domestic and international Revenues over time (**Table 1**).

Walmart generated $436.65 billion in net revenues from its US operations in fiscal 2021, compared to $402.5 billion in fiscal 2020. The company generated $122.5 billion from its overseas operations in fiscal 2021 compared to $121.4 billion in fiscal 2020. The company's total net revenues for fiscal 2021 jumped to $559.15 billion from $524 billion in fiscal 2020. In fiscal 2020 (ended Jan 31, 2020), Walmart generated $402.5 billion from its US operations and $121.4 billion from non-US operations. The company's total revenue climbed to $524 billion in fiscal 2020 from $514.4 billion in fiscal 2019.

5. Walmart's SWOT analysis and results

The SWOT analysis shows that the corporate's leading position in the international retail market is based on Walmart's strengths and competitive advantages. These advantages are used in contradicting the influences of competing retailers and digital content distribution companies especially, Amazon, Kroger, Apple, and Google. According to Walmart, the SWOT analysis provides insights into the internal and external factors important in Walmart's strategy development in the retail market. Whereas these factors fluctuate over time, its growth underpins its ability to exploit its retail effectiveness and strengths. Although it has weaknesses, its strengths are far more major considerations. Walmart can employ these strengths to capitalize on its opportunities in the retail industry as Walmart uses its strengths to counteract the threats to its retail business, particularly its e-commerce procedures[5] (**Table 2**).

As clarified in the above table, the SWOT analysis of Walmart shows how Walmart can have higher long-term success potential over aggressive global

[5] Source: Walmart SWOT Analysis & Recommendations - Panmore Institute.

Strengths (Internal Forces)	Weaknesses (Internal Forces)
1. Global organizational size	1. Thin profit margins
2. Global supply chain	2. Easily copied business model
3. High efficiency of supply chain	3. Competitive disadvantage against high-end specialty sellers
Opportunities (External Forces)	**Threats (External Forces)**
1. Expansion in developing countries	1. Healthy lifestyle trend
2. Improvement in human resource practices to develop competitiveness in the labor market	2. Aggressive competition
3. Improvement in quality standards	3. Online retailers of various sizes

Table 2.
Walmart's SWOT analysis. Source: Adapted by the Author.

expansion, particularly in retail markets in developing countries. Walmart's internal factors (strengths and weaknesses) represent capabilities for this type of expansion. Nevertheless, Walmart's external factors (opportunities and threats) need to create more value through the retail service value chain to overwhelm the hindering force of competitors and influential local and regional incumbents.

6. Conclusions and recommendations

Conclusion This study concludes that there are different justifications that Walmart has proved good for the US market and international market. One of these is how it has been assisting people to buy at low prices and save money. Scale, technology, size and shopping accessibility have assisted Walmart in developing the competitive advantage of brand loyalty. However, accomplishing this advantage is not an easy job because Walmart needs to reduce overhead costs. Currently, it is working even aggressively to implement business growth and keeping low prices[6]. This study also concludes that Walmart's international expansion has taken place rapidly, and the most critical factor is that Walmart is concerned with competition. The retail market of the US has reserved growing hyper-competitive. Numerous non-U.S. brands have also accessed the market, but some are equipped with a price advantage.

This study concludes that Walmart's management accounting practices have helped them conduct relevent forecasts and predictions, allowing for evaluating the retail inventory industry. It also recognizes that Walmart's costing methods and cost allocation helped reinforce its current position as a leader in the international retail market. The study found that management accounting practices at Walmart have been implemented to support their global operations, including the e-business model. The Walmart accounting system supports the vendor-management inventory model essential in minimizing costs and capacity to sell products at low prices. With the allocation of the costs, Walmart implements a cost leadership strategy by minimizing costs, thus supporting corporate profitability and financial stability.

The study recognizes that Walmart has also concentrated on using advanced technology for better results from its business. Inventory and cost management is a key driver of managing a great retail system. Walmart has used a more efficient supply chain system by handling a direct relationship with the producers. This leads

[6] Source: Walmart's Business Strategy: A case study of cost leadership and technological innovation - notesmatic.

to greater cost-effectiveness and better savings which can be transmitted to the customers through low product prices.

Based on SWOT analysis, Walmart should prioritize using its strengths to exploit opportunities in the international retail market. Walmart's weaknesses and threats can be secondary priorities. Walmart can develop its HR management and product quality standards to increase corporate performance. At the same time, Walmart must continue extending its business to capitalize on economic opportunities in developing markets. Walmart's strengths are based on its global corporate size and international supply chain, supporting aggressive international expansion in foreign markets. However, Walmart must implement strategic changes based on the weaknesses and threats introduced in the SWOT analysis to prepare the business for the longstanding developments of a globalized and gradually online retail market.

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References

[1] Walmart Report, 2017. Retrieved from: https://cdn.corporate.walmart.com/3a/73/1a181d66407686dd9bd6d1a4b0ae/wmt-2017-ar.pdf

[2] Bromiley, P., & Rau, D. (2016). Missing the point of the practice-based view. Strategic Organization, *14*(3), 260-269.

[3] Gilbertson, C. B. & Lehman, M. W. (2008). "Fundamentals of Accounting: Course 1". USA: Cengage Learning.

[4] Alsharari, N. M. (2017a). Institutional logics and ERP implementation in public sector agency. The Journal of Developing Areas, *51*(2), 417-425.

[5] Alsharari, N. M. (2017b). The development of accounting education and practice in an environment of socio-economic transformation in the Middle East: The case of Jordan. International Journal of Educational Management, 31(6), 736-751.

[6] Abou Samra, R., AlSharari, N., & AlTunaiji, S. (2020). Conceptual model for challenges and succession opportunities for virtual project teams in the GCC. In *Future of Information and Communication Conference* (pp. 328-340). Springer, Cham.

[7] Alsharari, N. M., & Alhmoud, T. R. (2019). The Determinants of Profitability in Sharia-Compliant Corporations: Evidence from Jordan. Journal of Islamic Accounting and Business Research, (just-accepted).

[8] Alsharari, N.M., Al-Shboul, M. and Alteneiji, S. (2020), "Implementation of cloud ERP in the SME: evidence from UAE," Journal of Small Business and Enterprise Development, Vol. 27 No. 2, pp. 299-327. https://doi.org/10.1108/JSBED-01-2019-0007.

[9] Alsharari, N. M., Alomari, A., & Alnesafi, A. (2020). Costs allocation practices and operations management in the hotels' industry: evidence from UAE. International Journal of Innovation, Creativity, and Change, 14(5), 512-545.

[10] De Souza, C., Pesserl, F., & Merry, S. (2002). US Patent Application No. 09/730,383.

[11] Fishman, C. (2007). "The Wal-Mart Effect: How an Out-of-town Superstore Became a Super Power," Penguin Books Limited, 01-Feb-2007.

[12] Roberts, B., & Berg, N. (2012). *Walmart: Key Insights and practical lessons from the world's largest retailer*. Kogan Page Publishers.

[13] Walmart Annual report 2010 to 2012. Retrieved from: http://stock.walmart.com/annual-reports Accessed on Oct 25, 2012

[14] Alsharari, N. M. (2019a). Management accounting and organizational change: alternative perspectives. International Journal of Organizational Analysis, (Accepted Manuscript).

[15] Alsharari, N. M. (2019b). A comparative analysis of taxation and revenue trends in the Middle East and North Africa (MENA) Region. Pacific Accounting Review, (just-accepted).

[16] Alsharari, N. M. (2016a). Results-Based Costing (RBC) System: Questioning the Unit of Analysis in ABC. Corporate Ownership and Control, 13(2), 587-603.

[17] Alsharari, N.M. (2021a), "Institutional change of cloud ERP implementation in the public sector: A transformation of strategy," International Journal of Disruptive Innovation in Government, Vol. 1 No. 1, pp. 2-14. https://doi.org/10.1108/IJDIG-03-2019-0002

[18] Alsharari, N.M. (2021b), "Risk management practices and trade facilitation as influenced by public sector reforms: institutional isomorphism," Journal of Accounting & Organizational Change, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JAOC-11-2018-0117

[19] Langfield-Smith K, Thome H, Hilton RW (1995). Management Accounting: An Australian Perspective, McGraw-Hill, Sydney.

[20] Adesina, O. T., Ikhu – Omoregbe, S., & Aboaba, K. O. (2015). Accounting information and profit planning: The case of Nigeria listed manufacturing companies. European Journal of Accounting Auditing and Finance Research, 3(4), 86-97

[21] Alsharari, N. M. (2018a). Internationalization of the higher education system: an interpretive analysis. International Journal of Educational Management, 32(3), 359-381.

[22] Alsharari, N. M., Eid, R., & Assiri, A. (2019). Institutional contradiction and BSC implementation: comparative organizational analysis. International Journal of Organizational Analysis. (Accepted Manuscript).

[23] Alsharari, N. M. (2019c). Accounting changes and beyond budgeting principles (BBP) in the public sector. International Journal of Public Sector Management, (just-accepted).

[24] Alsharari, N. M. (2019d). Internationalization market and higher education field: institutional perspectives. International Journal of Educational Management, (just-accepted).

[25] Alsharari, N. M. (2018b). Multilevel institutional analysis of accounting change in public management. International Journal of Organizational Analysis, 26(1), 91-106.

[26] Agrawal, N., & Smith, S. A. (2013). Optimal inventory management for a retail chain with diverse store demands. European Journal of Operational Research, 225(3), 393-403.

[27] Huge, EC, 1988, The Spirit of Manufacturing Excellence, Irwin, U.S.

[28] Alsharari, N. M. (2016b). The Diffusion of Accounting Innovations in the New Public Sector as Influenced by IMF Reforms: Actor-Network-Theory. International Journal of Actor-Network Theory and Technological Innovation (IJANTTI), 8(4), 26-51.

[29] Alsharari, N. M. (2016c). Management Accounting Relevance: Practice, Variance and Current Research Agenda, UOS JOURNAL FOR HUMANITIES AND SOCIAL SCIENCES, University of Sharjah.

[30] Walmart 2018 Annual Report. (2019). Retrieved Aug 21, 2019, from https://s2.q4cdn.com/056532643/files/doc_financials/2018/annual/WMT-2

[31] Porter, M. E. (2008). Competitive advantage: Creating and sustaining superior performance. Simon and Schuster.

[32] Brea-Solis, H., Casadesus-Masanell, R., & Grifell-Tatje, E. (2012). Business Model Evaluation: Quantifying Walmart's Sources of Advantage. Harvard Business School.

[33] Frazer, M. & Stiehler, B. E. (2014). Omnichannel retailing: The merging of the online and offline environment. Global Conference on Business and Financial Proceedings,9(1), 655-657.

[34] Klosek, N., (2012). Creating the Omni-Channel. Dealerscope, 54(11), 1-4.

[35] Ulrich, R. B., Jones, N. A., Lewis, J. C., Todd, J., Webb, T., & Cox, R. (2011). US Patent No. 7,997,486. Washington, DC: US Patent and Trademark Office.

[36] Fearne, A., Garcia Martinez, M., & Dent, B. (2012). Dimensions of sustainable value chains: implications for value chain analysis. Supply Chain Management: An International Journal, 17(6), 575-581.

[37] Gagnon, S. (1999). Resource-based competition and the new operations strategy. International Journal of Operations & Production Management, 19 (2), pp. 125-138.

[38] Hayes, R. H. & Pisano, G. P. (1996). Manufacturing Strategy: At The Intersection Of Two Paradigm Shifts. Production and Operations Management, 5(1), pp. 25-40

[39] Wernerfelt, B. (1984). A Resource-based View of the Firm. Strategic Management Journal, 5, pp.171-180.

[40] Alsharari, N. M. & Al-Shboul, M. (2019). Evaluating qualitative research in management accounting using the criteria of "convincingness." Pacific Accounting Review, (Accepted Manuscript).

[41] Almasarwah, A., AM Omoush, Nizar Alsharari (2018). IFRS compliance and stock prices influence evidence from Jordanian banks, Banks and Bank Systems.

[42] Walmart Homepage 2012. Retrieved from: http://corporate.walmart.com/our-story/our-stores Accessed on: Oct 25, 2012

[43] Walmart annual report, 2020. Retrieved from: https://corporate.walmart.com/media-library/document/2020-walmart-annual-report/_proxyDocument?id=00000171-a3ea-dfc0-af71-b3fea8490000

[44] Alsharari, NM and AA Lasyoud (2019), Is Traditional Management Accounting Still in Use? Contemporary Issues, Journal of Accounting Dynamics and Business.

[45] Alsharari, NM and R Abousamra (2019), Financial Crisis, Bad Debt and Uncollectible Receivables: Evidence from UAE, Indonesian Management and Accounting Research.

[46] Drury, C. (2006). "Cost and Management Accounting: An Introduction." USA: Cengage Learning EMEA.

[47] Brigham & Daves, P. R. (2012). "Intermediate Financial Management." USA: Cengage Learning.

[48] Al-Shboul, M., & Alsharari, N. (2018). The dynamic behavior of evolving efficiency: evidence from the UAE stock markets. The Quarterly Review of Economics and Finance, (Accepted Manuscript).

[49] Ailworth, E. (2012). "Walmart to install solar panels on 27 stores in Mass." Retrieved from: http://bostonglobe.com/business/2012/05/14/walmart-install-solar-panels-stores-mass/kxHjt9sQrPxSvN5sPWTjsN/story.html Accessed on Oct 25, 2012

Chapter

Accounting in a Social Context

Orla Feeney

Abstract

Accounting permeates all of society. Accounting information is not homogenous and varies not just from company to company but from user to user, meaning that the use of such accounting information is actually a social phenomenon within an organization. Accounting cannot therefore be understood simply in terms of its functional properties but more as a socially constructed set of actions taking place within the organization, the landscape of which is constantly transforming. Digital technologies in the form of big data and artificial intelligence (AI) are expanding the organization's data eco-system forcing the accountant to develop their digital technology skillset and forge links with the data scientist, the incumbent custodian of these growing data streams. Meanwhile, a rapidly expanding sustainability agenda is broadening the organization's biophysical landscape leading to even more data flows and creating the need for management accounting and control systems which will help organizations to behave in an environmentally sustainable and socially responsible manner. This chapter explores each of these issues and calls for a deeper understanding of the relationship between accounting and big data, AI and sustainability.

Keywords: management accounting, big data, data analytics, artificial intelligence, environmental management accounting, sustainability accounting, critical research, multidisciplinary research

1. Introduction

Accountants operate within a complex web of business practices involving a wide range of actors and clusters of actors performing a variety of activities. Accounting itself is not as prescriptive or normative as conventional wisdom would suggest. It is embedded in the every-day interactions taking place throughout the organization [1] and is best understood by taking a broad view over the organization's social system in order to develop a complete picture of the clusters of actors involved. Exploring the work of the accountant as a social phenomenon reveals it to have a complex relationship with those who use it. Critical, multidisciplinary research facilitates a depth of insight into the sociological implications of accounting information use, and in turn the role of the accountant.

Accounting and the practice of accounting permeates all of society. It influences how people behave, it is used to exert power, legitimize action and signify intent. Sociologically informed research helps us to understand why accounting is practiced in the way that it is and how these practices might evolve. Accounting research, and we are focusing here on management accounting research, was not always viewed through this broad, societal lens. Section 2 in this chapter sets out how management accounting research has evolved over the past three decades

enroute to its current pluralistic 'boundaryless' management accounting research landscape. Sections 3 and 4 examines the increasing scope and complexity of the accountant's role resulting from Big Data and Artificial Intelligence (AI) respectively, while the growing sustainability agenda is discussed in Section 5. Section 6 concludes the chapter by exploring opportunities for future research in management accounting.

2. The road to a sociological research agenda

Johnson and Kaplan [2] initiated concerns in their seminal text 'Relevance Lost: The Rise and Fall of Management Accounting' as to the continued relevance of management accounting techniques in light of then changes in the business environment. This was followed by a decade of criticisms of the management accounting discipline coupled with suggestions for improvement in the form of new and improved techniques such as Activity Based Costing [ABC] and the Balanced Scorecard [3–7]. Subsequent, empirical research suggested that traditional techniques such as budgets, variance analysis and standard costing were as popular as ever, while more contemporary tools were enjoying only modest application [8, 9]. Changes occurring in the accounting profession were not necessarily in the tools and techniques which the accountants were using but more in who was performing these tasks and how they were being performed [10]. Accountants were being required to provide non-financial data [11] and 'softer', more strategically relevant information [12]. The 1990s also witnessed vast improvements in field-based research methods, resulting in more studies being conducted, addressing issues not previously focused on in the management accounting literature [13]. Topics such as the accountant's skills and competencies, management accounting practices and the impact of change on the accountant all became key areas for analysis [14–16]. Increasingly the literature was presenting an accountant who interpreted information so as to facilitate control in a contemporary business environment and contribute to decision-making in a more useful manner. The term 'hybrid accountant' [17] was coined to encapsulate this dual role of the modern accountant.

A large body of literature emerged which explored this evolution of the accountant's role from a bean-counter to a type of business advisor [18, 19]. Developments in advanced manufacturing technology [20], information technology [21] and Enterprise Resource Planning (ERP) [22] facilitated the decentralization of accounting information which discharged the accountant of much of their traditional scorekeeping duties [23], and the proliferation of an array of contemporary strategic management accounting (SMA) techniques enabled the accountant to play a key role in the development and execution of organizational strategy [24]. This 'business partner' placed greater emphasis on communication, people skills and general business acumen [25]. Their expanding role incorporated newer and wider dimensions such as consultant, advisor and change agent, but alongside the traditional function of financial monitoring and scorekeeping. Here we begin to observe the accountant influencing organizational behavior. As opposed to just retrospectively reporting results, accounting is being used to exert power, legitimize action and signify intent [26].

In unearthing an accountant who supports the organization in responding to changes in technology, product innovation, organizational structures and consumer markets we began examining accounting in a social and institutional context [27–30] and it is through this critical, multi-disciplinary lens we must look to the future of accounting. Technology substantially changed the nature of work for accountants intensifying the evolution of the accountant's role from a bean-counter to a type of business advisor [19]. Today, digital technology is impacting how organizations

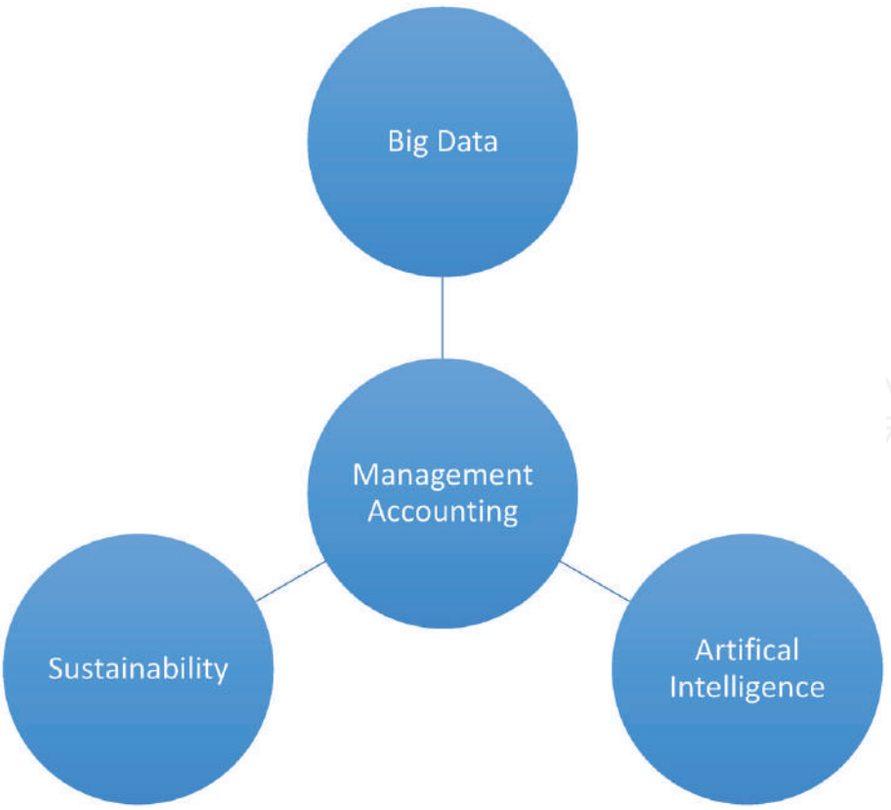

Figure 1.
Management accounting data flows.

process information, make decisions and formulate strategy. Digital technology blurs the boundary between inside and outside the organization, reshaping organizational relationships through enhanced connectivity and ever-growing interactions. The sociological map surrounding the accountant is growing. It has never been more important to explore the sociological implications of these organizational changes so as to understand the existing and potential relationships between individuals, groups and organizations in the context of accounting information use.

The work of accountants will undergo major changes in the future as a result of technological advancement. Some roles and tasks will remain under the remit of the accountant but will evolve in nature, some will not be performed by humans at all and new roles will emerge as accountants increasingly collaborate with digital technologies. The next two sections examine the changing role of accounting in this complex and evolving business environment as it transforms in the wake of data and AI. In addition, as the growing research agenda around sustainability accounting acknowledges the increasing interaction between accounting and the society around them, section five looks at some of the information flows emerging from organizations' interactions with their physical and social environment and how this too has implications for the future role of accountants (**Figure 1**).

3. Big data

Data plays a central role in all aspect of society, from business to government to individuals' everyday lives. Data is behind everything we see, hear and do in the world. The term Big Data reflects the voluminous information flows emerging from today's data driven environment. It provides new ways of 'making sense of, doing work in, managing, or imposing control upon different aspects of the social world ([31], p. 1)'.

The term itself is difficult to define but it is best understood in terms of the four Vs- huge volume, high velocity, broad variety and uncertain veracity [32]. The volume, velocity, and variety of this data simply means that vast amounts of transactions are quickly created and captured from a wide variety of sources [33]. Veracity refers to the accuracy and reliability of the data [34]. Ultimately, big data refers to enormous data sets which cannot be managed or analyzed using traditional software programs [35]. Automatic sensor devices, machine to machine communication, web site traffic, email and social media postings are continuously generating data [36]. This creates various technical challenges in terms of data access, storage and processing but the real challenge is in determining how to effectively use this data to make organizations better. Data is a corporate asset now [37] and effectively managing data has become critical to establishing and maintaining competitive advantage [38]. Organizations have been forced to expand the scope of their information system from traditional internal data processing to automated data capture connecting businesses to suppliers, affiliates and consumers on a real time basis. Critically, the organizations's data ecosystem is expanding [32] and this significantly affects how data are accumulated and recorded, how reports are processed and assembled and ultimately how management uses data to achieve its objectives. As a result, in addition to being more commercially focused and strategically aware, the accountant's scope of analysis has broadened.

Let us be clear, accumulating data is relatively easy. For it to be useful in a management accounting context it must be understood, mined, analyzed and incorporated into control and decision-making. Accounting, in a broad sense, provides a set of techniques, rationales and practices for doing this kind of work relatively efficiently. And indeed several scholars have suggested how big data ought to be successfully integrated into accounting and control systems [32, 36], decision-making processes [39, 40]; operational and strategic planning [41, 42] and management control [32]. For instance, traditional budgeting has been criticized for its inward focus, preventing rapid reactions to changes in the business environment and stifling creativity and innovation [43–48]. The Beyond Budgeting model developed in response to these criticisms reflects a more agile and people oriented organization which ties organizational goals to peers, competitors and global benchmarks [49]. Big Data is poised to enhance Beyond Budgeting methodologies by incorporating a broad array of data streams enabling the development of new and alternative ways of analyzing and controlling organizational performance.

We are, however, lacking empirical insight as to whether this is actually happening, and if it is, how. Big data can offer accountants opportunity for further reinvention. They are experienced at gathering and analyzing financial data and this experience can be applied to a variety of non-financial and other data sets, but for this data to have a management accounting application, the accountant will need to upskill- to bridge the gap between themselves and the IT department, specifically, the data scientist who traditionally manages data [50]. Again, accumulating data is easy. Arguably, analyzing data is also relatively easy. But effectively incorporating this data into management accounting procedures and practices requires a proactive effort on the part of the management accountant and this requires education at a professional level- developing a stronger skillset in the techniques and technologies of big data in combination with the accountant's natural analytical skills [51].

A consistent feature of the literature relating to management accounting and big data is its prevalence of largely normative assertions suggesting how big data ought to enhance accounting processes and information and the role the accountant ought to play in facilitating this. Empirical reviews testing these assertions are scarce and so we are left with a limited understanding of where the accountant sits in this new organizational map. Future research in this area must explore how big data and

accounting interact within a social and institutional context. A critical view should be used to explore how the varying motivations and objectives of different users and groups of users are implicated in this evolving relationship. Big data is more than a technical phenomena and to understand it in an accounting context requires an exploration of its social origins.

4. Artificial Intelligence

Artificial Intelligence [AI] and related technologies were initially prevalent in more process-oriented activities but have now progressed into the knowledge sector, creating a unique opportunity for professionals to rethink how they engage with their role in an organizational context [52]. While some suggest that a variety of accounting roles will be replaced by AI-related technologies [53] there is a growing recognition that accounting can in fact harness AI's potential to add value to organizations [54, 55].

AI systemizes activities which are associated with human intelligence including planning, learning, reasoning, problem solving, knowledge representation, perception, manipulation, and to a lesser extent, social intelligence and creativity [56–58]. The key difference between an AI and a non AI application is that AI tools learn to do their job and advance based on experience without being explicitly programmed [59].

AI methods such as data mining and machine learning extract knowledge and learn how to act and interact with their environments. Data mining extracts knowledge from large volumes of data using techniques such as regression, classification, association rules, pattern recognition, outlier detection, anomaly detection, and clustering [60]. Data mining techniques used in machine learning predict future outcomes by identifying patterns in clusters of data and building models of what is happening in the data. Machine learning is an application of AI that enables systems to learn and advance based on experience. Deep learning is a specialized form of machine learning that emulates the way the human brain works by processing information and building patterns for making decisions. It uses computational models involving several processing layers to learn representations and patterns of data with multiple levels of abstraction [61]. Essentially computers are teaching themselves to write software to solve problems and make decisions [62].

While AI presents a number of opportunities and challenges for the discipline, it is not an entirely new phenomenon in an accounting context. First generation artificial intelligence in the form of expert systems, knowledge based systems and intelligent systems have existed for decades. Expert systems developed in the 1980s attempted to replicate human expertise and transform it into rules to perform accounting tasks [63]. They arguably did not live up to their potential [64], probably because they were based on 'if-then' rules and decision-trees which frequently codified flawed logic facilitating the same mistakes to be made over and over again [65]. However, with artificial intelligence supporting these knowledge-based systems, together with more emphasis on data analytics and the associated use of machine learning techniques, increased use of artificial intelligence in accounting seems inevitable [66].

The ability of AI technology to automate work, combined with the availability of big data as discussed earlier [32] together with the use of smart big data analytics [67, 68] elevate the true potential of AI to replace human endeavor [69]. With AI-based technologies, as people use and communicate with these tools, they are creating new routines while simultaneously facilitating the programming of autonomous working tools to take over certain areas of activity [70].

This raises questions as to which aspects of human work in accounting will be transferred to AI software. Prior research has focused on accounting and the automation of data processing and transaction based activities [71–73]. However, the digitisation of the accounting function using AI and big data analytics appears only to increase the network of people and software, both within and outside the organization, creating more data pools and, dare we say, more decisions [74]. It is as though the accounting function will be responsible for handling and using even more data [75] and the real value of digital technology will be in enhanced planning, control and forecasting in this significantly broader information ecosystem [76, 77].

It has been suggested that, societally, tasks requiring medium qualification levels are more likely to be digitized, meaning that individuals with low, or indeed high, qualification levels will still be required in the workforce [56]. In accounting, we have seen how the automation of more procedural tasks have freed the accountant up for more complex work [75, 78]. It is expected that digital technologies will continue this trend. AI and data analytics will increase the quantity and complexity of data and information flows increasing the demand for well qualified accounting professionals to use this information to good effect [79]. This suggests that the qualification level demanded of accounting professionals will continue to increase even when accounting systems increasingly incorporate AI technologies [74, 75]. Accountants themselves can play a key role in the implementation and operation of digital technologies in increasingly complex organizational settings. However, to achieve what is characterized in the literature as a 'human-machine symbioses' accountants must develop competencies in digital technologies and analytics [80].

Again, research in this area, despite our enlightened sociological research agenda, is largely normative consisting mainly of assertions as to how accountants can engage with AI, or more alarmingly, how accountants will ultimately be replaced by AI! The reality is much more nuanced. The role of the accountant will indeed be subject to major change in the coming ten years in keeping with the broader digital transformation of society. Key accounting roles and tasks are set to stay- some will not be performed by humans but by AI. New accounting roles and tasks will emerge and will perhaps be performed by humans in collaboration with AI. It is clear that organizational structures, networks and boundaries are likely to shift as AI and human accounting functions interact with the similarly mixed accounting functions of external partners and third parties. This is where we see a real expansion in the sociological map surrounding the accountant. Understanding these phenomena in a social context will allow us to understand why accounting is evolving in response to AI in the way that it is and how things might be done differently.

5. Accounting and sustainability

In 1987, the United Nations (UN) World Commission on Environment and Development described sustainable development as meeting 'the needs of the present without compromising the ability of future generations to meet their own needs' [81]. The UN's agenda for sustainable development centers around 17 sustainable development goals (SDGs) which have a variety of objectives including eradicating poverty and hunger, encouraging well-being, education and gender equality and promoting responsible consumption, climate change and environmental sustainability (see **Figure 2**). In 2019, Heads of State and Government gathered at the United Nations Headquarters in New York to comprehensively review progress in the agenda for sustainable development. This resulted in world leaders

Figure 2.
The United Nation's 17 SDGs [82].

and leading sustainability activists collectively calling on governments, economies and the business sector to gear up for a decade of action and delivery on issues of sustainable development [83].

Businesses are becoming increasingly compelled to manage their social and environmental performance alongside their financial performance. The extent to which they do this will depend on the organization's core values, business strategy, external stakeholders, and regulatory environment but it is important to recognize that companies do not need to be 'in the business of sustainability' to ensure that sustainability objectives are integrated into their management accounting systems. A lot of what organsations do in their day to day activities and operations, is already subscribing to a sustainability agenda but there is now a growing recognition that prioritizing sustainability in areas like supply chain transparency, staff health and well-being and climate resilience creates organsational value, through brand recognition, conscious consumerism and even government support.

'Sustainability' has grown in prominence within the accounting literature [80, 84–87]. Research in the area covers broad territory, e.g. linking sustainability initiatives to company strategy [88], examining the efficacy of sustainability control systems [89], exploring accounting and sustainable development goals [90], examining carbon accounting [91] and investigating how management accounting can improve the organization's environmental performance [92] – but ultimately it recognizes that organizational decision making must be based on a combination of financial, ecological, and social data. Accounting, as a discipline, has leadership potential in this area. Accountants can help managers to understand the environmental and social impacts of business operations and benchmark their corporate, social and environmental performance. This requires further expansion of their role and some adaption of their management accounting toolkit, but accountants have proven adept at evolving in response to changes both within and around the organization – this simply represents the next stage in that evolution.

When discussing big data and AI we acknowledged the organization's expanding data eco-system. The growing sustainability accounting agenda reveals how organizations are also operating within a larger biophysical and social environment than

ever before [88]. Accounting in this context is complex – crossing organizational boundaries, impacting a broadening range of stakeholders resulting in a variety of implications for different aspects of the accounting sphere. However, academics have a moral imperative to move this topic even higher up the research agenda. We need to better understand what motivates corporations to pursue different sustainability strategies, and how managers implement effective management accounting and control systems to achieve improved sustainability outcomes.

6. Conclusions: future directions for management accounting research

It is clear that the continued development of accounting will be subject to technological change in the form of big data and AI which will place new demands on the accountant. The lack of necessary skills and competencies to handle these technologies is still a major barrier to a fully successful partnership between digital technology and accounting. The accounting profession has traditionally lagged general business adoption of emerging technologies [93] so the professional bodies as well as educators at university level have a role to play in improving the technical preparedness of future generations of accountants. As well as an upgrading of qualifications, these technologies demand new forms of collaborations and interactions. Accountants must play a key role in bridging the gap between the business functions and the data scientist, the current custodian of the big data treasure chest [32]. With all of this in mind it is not possible to fully assess the effect these technologies will have on the role of accounting as a whole, but it is clear that some form of human–machine symbiosis is on the horizon and this requires critical and continuous attention from researchers [94, 95].

Accounting and the practice of accounting permeates society and nowhere is this more evident than in the continued quest to incorporate management accounting and calculative mechanisms into societal and environmental matters [96]. Organizations are under increasing pressure to behave in an environmentally sustainable and socially responsible manner whilst still maintaining profitability. Big data and AI facilitate the expansion of the organizations data ecosystem, the growing sustainability imperative broadens the organizations biophysical landscape creating even more data flows.

Let us be clear, the goal of management accounting remains unchanged. Its primary function is to support planning, control and decision-making, but accounting cannot simply be understood in terms of its functional properties. Yes, accounting is about measuring, calculating and reporting but, ultimately, it is a socially constructed set of actions in which organizational individuals construct, reconstruct, and interpret accounting information depending on how they personally interact with the management accounting system as well as their exposure to other systems throughout these interactions [97]. Management accounting has proven its capacity to adapt and evolve in response to an increasingly unpredictable and innovative environment [98], and accountants have already demonstrated their ability to mediate between internal and external parties with regard to expectations and deliverables [99]. But this chapter demonstrates the extent to which future developments in accounting, and the research which explores these phenomena, must have big data, AI and sustainability at its core.

This chapter calls for a deeper understanding of the relationship between accounting and big data, AI and sustainability, which moves beyond normative assertions and suggestions of how things ought to be. Future research in accounting must acknowledge that boundaries shift and alter in time and space [100]. According to Quattrone ([101], p. 120) 'the realm of the measurable' is expanding

with the result that research approaches characterized by epistemological diversity, framed in psychology, sociology or organizational theory will provide a fresh perspective in examining the evolution of accounting in a less static way.

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References

[1] Feeney, O. and Pierce, B. Accounting and new product development: The importance of interactions within social and technical structures. Qualitative Research in Accounting and Management. 2018: 15: 2: 251-279

[2] Johnson, H. T. and Kaplan, R. S. Relevance lost: the rise and fall of management accounting. Boston: Harvard Business School Press. 1987

[3] Cooper, R. and Kaplan, R. S. How cost accounting systematically distorts products costs. In Bruns, W Jnr and R.S. Kaplan, R. S., editors. Accounting and Management: Field Study Perspectives. Boston: Harvard Business School Press. 1987

[4] Cooper, R. and Kaplan, R. S. Measure costs right: make the right decisions. Harvard Business Review: 1988: 88:5:96-10.

[5] Cooper, R. and Kaplan, R. S. The design of cost management systems: texts, cases and readings. New Jersey: Prentice Hall. 1991

[6] Kato, Y. Target costing support systems: lessons from leading Japanese companies. Management Accounting Research. 1993: 4: 1: 33-48

[7] Bromwich, M. and Bhimani, A. Management Accounting: Pathways to Progress. 1994. London: CIMA

[8] Pierce, B. and O'Dea, T. An empirical study of management accounting practices in Ireland. The Irish Accounting Review. 1998: 5: 2: 35-65

[9] Burns, J. and Yazdifar, H. Tricks or Treats. Financial Management. 2001. March: 32-35

[10] Scapens, R. Turley, S., Burns, J., Joseph, N., Lewis, L. and Southworth, A. External financial reporting and management information: A survey of UK management accountants. Management Accounting Research. 1996: 7: 1: 73-93

[11] Drury, C., Braund, S., Osborne, P. and Tayles, M. A survey of management accounting practices in UK manufacturing companies. London: CIMA Publishing. 1993

[12] Roslender, R. Relevance lost and found: critical perspectives on the promise of management accounting. Critical Perspectives on Accounting. 1996: 7: 5: 533-561

[13] Scapens, R. W. and Bromwich, M. Management accounting research: the first decade. Management Accounting Research. 2001: 12:1/2:245-254

[14] Brignall, S., Fitzgerald, I., Johnson, R. and Markou, E. Improving service performance: A step change towards continuous improvement. 1999. London: CIMA Reseearch Publishing

[15] Granlund, M. and Lukka, K., Toward increasing business orientation: Finish Mas in a changing cultural context. Management Accounting Research. 1998: 9

[16] Friedman, A. L. and Lyne, S. R. Activity based techniques and the death of the beancounter. European Accounting Review. 1997: 6:1:19-44

[17] Burns, J., Ezzamel, R. and Scapens, R. Management Accounting Change in the UK. Management Accounting. 1999. March:28-30

[18] Scapens, R. W., Ezzamel, M., Burns, J. and Bolvinsdottir , G. The future direction of UK management accounting practice. London: Elseview CIMA Publications, 2003

[19] Jarvenpaa, M. Making business partners: A case study on how

management accounting culture was changed. European Accounting Review. 2007: 16: 1: 99-142

[20] Bhimani, A. and Bromwich, M. Prospect and retrospect. 2010. London: CIMA

[21] Pierce, B. and O'Dea, T. Management accounting information and the needs of managers: Perceptions of managers and accountants compared. The British Accounting Review. 2003: 35: 3: 257-290

[22] Scapens, R.W. and Jazayeri, M. ERP systems and management accounting change: opportunities or impacts? A research note. European Accounting Review. 2003 :12 : : 201-233

[23] Siegal, G. and Sorensen, J. E. The 1999 practice analysis of management accounting: USA: Institute of Management Accountant

[24] Yazdifar, H. and Tsamenyi, M. Management accounting change and the changing roles of management accountants: a comparative analysis between dependent and independent organizations. Journal of Accounting & Organizational Change, 2005:1: 2: 180-198

[25] Frezatti, F., Carter, D. B. and Barroso, M. F.G. Accounting without accounting: Informational proxies and the construction of organisational discourses. Accounting, Audit & Accountability. 2014: 27: 3

[26] Hopwood, A. G. The archeology of accounting systems. Accounting, Organization and Society. 1987: 12: 3: 207-234

[27] Hopwood, A. G. Accounting and organization change. Accounting, Audit and Accountability Journal. 1990: 3: 1: 7-17

[28] Roslender, R. and Dillard, J. Reflections on the interdisciplinary perspectives on accounting project. Critical Perspectives on Accounting. 2003: 14: 3: 325-335

[29] Baker R. A genealogical history of positivist and critical accounting research. Accounting History. 2011: 16: 2: 207-221

[30] Broadbent, J. and Laughlin, R. Accounting Control and Controlling Accounting: Interdisciplinary and Critical Perspectives. Bradford: Emerald. 2013

[31] Van der Flist, F. Accounting for the social: Investigating commensuration and big data practices at Facebook. Big Data and Society. 2016: Jan-Jun: 1-16

[32] Vasarhelyi, M.A., Kogan, A. and Tuttle, B.M. Big data in accounting: an overview.Accounting Horizons. 2015: 29: 2: 381-396

[33] Merritt-Holmes, M. [2016]. Big Data & analytics: The DNA to a successful implementation in 2016, Whitepaper, The Data Analytics Report. 2016

[34] Zhang, J., Yang, X., & Appelbaum, D. Toward effective Big Data analysis in continuous auditing. Accounting Horizons. 2015: 29: 2: 469-476

[35] Syed, A., Gillela, K and Venugopal.C. The future revolution on Big Data. International Journal of Advanced Research in Computer and Communication Engineering. 2013: 2: 6: 2446-2451

[36] Warren, D. J., Moffitt, K. C. and Byrnes, P. How Big Data Will Change Accounting. Accounting Horizons, 2015: 29: 2: 397-407

[37] Brown, B., M. Chui, and J. Manyika. Are you ready for the era of 'Big Data?'. McKinsey Quarterly. 2011: Oct: 24-35

[38] Bughin, J., Livingston, J. and Marwaha, S. Seizing the potential of

'Big Data'. McKinsey Quarterly. 2011: Oct: 103-109

[39] McAfee, A., & Brynjolfsson, E. Big data: The management revolution. Harvard Business Review. 2012: 90, 61-68

[40] Côrte-Real, N., Oliveira, T., & Ruivo, P. Assessing business value of Big Data Analytics in European firms. Journal of Business Research. 2017: 70: 379-390

[41] Davenport, T. H. How strategists use 'Big Data' to support internal business decisions, discovery and production. Strategy & Leadership. 2014: 42: 4: 45-50

[42] Wang, G. Gunasekaran, A. Ngai, E. W. and Papadopoulos, T. Big data analytics in logistics and supply chain management: Certain investigations for research and applications. International Journal of Production Economics. 2016: 176: 98-110

[43] Neely, A., Sutcliff, M.R. and Heyns, H.R. Driving value through strategic planning and budgeting. New York: Accenture. 2001

[44] Hope, J. and Fraser, R. Beyond Budgeting – How Managers Can Break Free from the Annual Performance Trap, Boston: Harvard Business School Press. 2003

[45] Hansen, S., Otley, D. and Van Der Stede, W. Practice Developments in Budgeting: An Overview and Research Perspective. Journal of Management Accounting Research. 2003: 15: 95-116

[46] Horvath P., and Sauter R. Why budgeting fails: one management system is not enough? Balanced Scorecard Report. 2004: 6: 5: 8-11

[47] Pietrzak, Z. Traditional versus activity-based budgeting in non-manufacturing companies, Social Sciences. 2013: 82: 4: 26-37

[48] Zeller, T. L. and Metzger, L.M. Good by traditional budgeting, hello rolling forecast: Has the time come?', American journal of Business Education. 2013:6:3: 299 – 310

[49] Goode, M. and Malik, A. Beyond budgeting: the way forward? Pakistan Journal of Social Sciences. 2011:31: 2: 207-214

[50] Drew, J. Merging accounting with 'big data' science. Journal of Accountancy: 2018: July

[51] Chua, F. and Lawson, R. The data revolution. The Association of Chartered Certified Accountants and Institute of Management Accountants, 2015: November

[52] Chiu, M., Manyika, J. and Miremadi, M. Where machines could replace humans—and where they can't [yet]. McKinsey Quarterly. 2016: Jul

[53] Frey, C.B. and Osborne, M.A. The future of employment: how susceptible are jobs to computerisation? Technological Forecasting and Social Change, 2017: 114: 254-280.

[54] Issa, H., Sun, T. and Vasarhelyi, M. A. Research ideas for artificial intelligence in auditing: the formalization of audit and workforce supplementation. Journal of Emerging Technologies in Accounting. 2016: 13: 2: 1-20

[55] Issa, H., and Kogan. A. A predictive ordered logistic regression model as a tool for quality review of control risk assessments. Journal of Information Systems. 2014: 28: 2

[56] Autor D.H. and Dorn, D. The growth of low-skill service jobs and the polarization of the US labor market. The American Economic Review. 2013: 103:5: 1553-1597

[57] Autor, D.H., Levy, F. and Murnane, R.J. The skill content of recent

technological change: an empirical exploration. The Quarterly Journal of Economics. 2003: 118: 4: 1279-1333

[58] Bolton, C., Machova, V., Kovacova, M., and Valaskova, K. The power of human-machine collaboration: Artificial intelligence, business automation, and the smart economy. Economics, Management and Financial Markets. 2018: 4: 51-56

[59] Burstrom, T., Parida, V., Lahti, T. and Wincent, J. AI-enabled business-model innovation and transformation in industrial ecosystems: A framework, model and outline for further research. Journal of Business Research. 2021: 127: 85-95

[60] Gepp, A., Linnenluecke, M. A., O'Neill, T J and Smith, T. Big data techniques in auditing research and practice: Current trends and future opportunities. Journal of Accounting Literature. 2018: 40: 102-115

[61] LeCunY., Bengio, Y. and Hinton, G. Deep Learning. Nature. 2015: 521: 436-444

[62] Parloff, R. Why deep learning is suddenly changing your life. Fortune: 2016: 28 September

[63] Gregor, S. and Benbasat, I. Explanations from intelligent systems: theoretical foundations and implications for practice. MIS Quarterly. 1999: 23: 4:497-453

[64] O'Leary, D. E. Building and evolving data warehousing and business intelligence artefacts: The case of Sysco. Intelligent Systems in Accounting, Finance and Management, 2011: 18: 4: 195-213

[65] Makridakis, S. The forthcoming Artificial Intelligence [AI] revolution: Its impact on society and firms. Futures. 2017: 90:46-46

[66] Sutton, S, Holt, M and Arnold, V. The reports of my death are greatly exaggerated- artificial intelligence research in accounting. International Journal of Accounting Information Systems. 2016:22-60-73

[67] Cockcroft, S. and Russell, M. Big data opportunities for accounting and finance practice and Research. Australian Accounting Review. 2018: 28: 3: 323-333.

[68] Green, S., McKinney, E., Jr, Heppard, K. and Garcia, L. [2018], Big data, digital demand and decision-making. International Journal of Accounting and Information Management. 2018: 26: 4: 541-555

[69] Loebbecke, C. and Picot, A. Reflections on societal and business model transformation arising from digitization and big data analytics: a research agenda. The Journal of Strategic Information Systems. 2015: 24: 3: 149-157

[70] Leitner-Hanetseder, S., Lehner, O. M., Eisl, C and Forstenlechner, C. A profession in transition: actors, tasks and roles in AI-based accounting. Journal of Applied Accounting Research. *In Press*.

[71] Ghasemi, M., Shafeiepour, V., Aslani, M. and Barvayeh, E., The impact of information technology [IT] on modern accounting systems. Procedia – Social and Behavioral Science. 2011: 28: 112-116

[72] Guney, A. Role of technology in accounting and e-accounting. Procedia – Social and Behavioral Science. 2014: 152: 852-855

[73] Taipaleenmaki, J. and Seppo, I. On the convergence of management accounting and financial accounting – the role of information technology in accounting change. International Journal of Accounting Information Systems. 2013:14: 321-348

[74] Marrone, M. and Hazelton, J. The disruptive and transformative potential of new technologies for accounting, accountants and accountability, Meditari Accountancy Research, 2019: 27: 5: 677-694

[75] Oesterreich, T.D., Teuteberg, F., Bensberg, F. and Buscher, G. The controlling profession in the digital age: understanding the impact of digitisation on the controller's job roles, skills and competences

[76] Brynjolfsson, E. and McAfee, A. Race Against the Machine: How the Digital Revolution Is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy. Lexington Massachusettes: Digital Frontier Press, 2011

[77] Vial, G. Understanding digital transformation: a review and a research agenda. The Journal of Strategic Information Systems. 2019:28:2:118-144

[78] Zuboff, S. In the Age of the Smart Machine. The Future of Work and Power. 2011: New York: Basic Books, New York

[79] Hirsch-Kreinsen, H. [2015]. Digitalisierung von Arbeit: Folgen, Grenzen und Perspektiven. Soziologisches Arbeitspapier. 2015: 43

[80] Bebbington, J. and Larrinaga, C. Accounting and sustainable development: an exploration. Accounting, Organizations and Society. 2014: 39: 6: 395-341.

[81] United Nations. Our Common Future: Report of the World Commission on Environment and Development, Chapter 2 'Towards a Sustainable Development'. 1987. https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf [Accessed: 2021-04-26]

[82] Transforming our world: the 2030 Agenda for Sustainable Development. https://sdgs.un.org/2030agenda [Accessed: 2021-05-25]

[83] United Nations. Report of the SG on SDG Progress. 2019. https://www.un.org/sustainabledevelopment/progress-report [Accessed: 2021-04-26]

[84] Bebbington, J. and Gray, R. An account of sustainability: failure, success and a reconceptualization. Critical Perspectives on Accounting, 2001:12: 5: 557-588

[85] Unerman, J. and Chapman, C. Academic contributions to enhancing accounting for sustainable development. Accounting, Organizations and Society. 2014: 39: 6: 385-394.

[86] Hall, M., Millo, Y. and Barman, E. Who and what really counts?: stakeholder prioritization and accounting for social value. Journal of Management Studies. 2015: 52: 7: 907-934

[87] O'Dwyer, B. and Unerman, J. Fostering rigour in accounting for social sustainability. Accounting, Organizations and Society. 2016: 49: 32-40

[88] Joshi, S. and Li, Y. What Is Corporate Sustainability and How Do Firms Practice It? A Management Accounting Research Perspective. Journal of Management Accounting Research. 2016: 28: 1-11

[89] Ditillo, A., and I. E. Lisi, I. E. Exploring sustainability control systems' integration: The relevance of sustainability orientation. Journal of Management Accounting Research. 2016: 28: 2: 125-148

[90] Bebbington, J. and Unerman, J. Achieving the united nations sustainable development goals: An enabling role for accounting research.

Accounting, Auditing and Accountability Journal. 2018: 31: 1: 2-24

[91] Gibassier, D. and Schaltegger, S. Carbon management accounting and reporting in practice: A case study on converging emergent approaches. Sustainability Accounting, Management and Policy Journal. 2015: 6: 3: 340-365

[92] Schaltegger, S. and Zvezdov, D. Gatekeepers of sustainability information: exploring the roles of accountants. Journal of Accounting & Organisational Change. 2014: 11: 3: 333-361

[93] Dai, J. and Vasarhelyi, M. Imagineering Audit 4.0. Journal of Emerging Technologies. 2016: 13: 1: 1-15

[94] Gendron, Y., On the elusive nature of critical [accounting] research. Critical Perspectives on Accounting. 2018: 50: 1-12

[95] Palea, V. Whither accounting research? A European view. Critical Perspectives on Accounting. 2017: 42: 59-73

[96] Hopwood, A. G. Accounting and the environment? Accounting, Organizations and Society. 2009: 34: 3-4: 433-43

[97] Feeney, O. and Pierce, B. Strong structuration theory and accounting information: an empirical study. Accounting, Audit & Accountability Journal. 2016: 29: 7: 1152-1176

[98] Davila, A., Foster, G. and Li, M., Reasons for management control systems adoption: insights from product development systems choice by early stage entrepreneurial companies. Accounting, Organizations and Society. 2009: 34: 3-4: 322-347

[99] Carlsson-Wall, M., Kraus, K. and Lind, J. Strategic management accounting in close inter-organisational relationships, Accounting and Business Research. 2015: 45:1:27-54

[100] Jack, L. Accounting and social theory: an introduction. Abingdon Oxon: Routhledge; 2017

[101] Quattrone, P. Management accounting goes digital: will the move make it wiser? Management Accounting Research. 2016: 31: 118-122

Chapter

Survey on Blockchain Based Accounting and Finance Algorithms Using Bibliometric Approach

Sezer Bozkus Kahyaoglu and Tamer Aksoy

Abstract

The aim of this study is to evaluate the impact of blockchain especially on accounting and finance functions, the strategic role of CFOs, and to the restructuring process of accounting and finance functions in the future. In this respect, a business model is recommended that finance, accounting, and audit professionals can benefit from. It is aimed to contribute to the literature by providing blockchain adaptation and implementation strategy via providing information about accounting, finance, and auditing algorithm samples for revolutionizing these functions. To the best of our knowledge, this will be a pioneering work that makes a survey by examining blockchain algorithm samples in the field of accounting, auditing, and finance by using Bibliometric Network Analysis. In this analysis, six major clusters are estimated for defining the impacts of blockchain in the literature based on "Co-citation" aspects for the period 2005–2021 considering the SSCI indexed articles. In addition, the ranking of the top three contributing countries is found to be China, USA, and the UK respectively. This indicates the power of these countries to shape the future of accounting, finance, and auditing standards by means of producing blockchain algorithms and determining innovation policies of these professions in the future.

Keywords: blockchain, algorithms, accounting, finance, artificial intelligence, auditing, bibliometric network analysis

1. Introduction

One of the fast-paced innovations in accounting and finance is based on applications that have recently focused on blockchain. The major advantage of blockchain technology is that it offers a way to structure data without the need for any central authority [1–3]. In this context, the meaning of a blockchain in terms of accounting and finance function is to have a distributed ledger based on database structure that contains an ever-increasing number of accounting records [3–6]. In such a blockchain-based database, all records are in blocks, rather than being combined in a single file. Each block is chained to the next one in linear and chronological order using cryptographic infrastructure and signature [1, 2, 7]. Thus, if a change is attempted in the records, it can be seen by all participants within a predefined

verification in governance structure [8–10]. This approach refers to a situation where future businesses especially financial and accounting processes thereof are affected and forced to change [5, 11, 12]. In this context, future accounting and finance functions will be carried out based on algorithms [5, 11].

The organization of this chapter is as follows: Firstly, the impacts of blockchain on accounting and finance functions are explained. In this context, the effects of blockchain applications that change the "balance of power" between stakeholders are examined [9]. At the same time, areas of change regarding the future strategic position of CFOs and the restructuring process of accounting and finance functions come up for discussion. Secondly, blockchain algorithm samples in the field of accounting, finance, and auditing are presented by using bibliometric methods, i.e., "VOSviewer" [13] and "Bibliometrix" via R Program [14]. "VOSviewer" is a software tool based on web of science (WOS), and this tool is mainly used for constructing and visualizing bibliometric networks [13]. In conclusion, policy recommendations are made based on the survey results for the professionals and academics to contribute to the literature.

2. The impacts of blockchain on accounting and finance functions

Blockchain is a creative response to replace a trusted intermediary position in various fields and processes of accounting and finance functions [1, 2]. In the literature, Yermack [15] first demonstrated the advantages offered by the blockchain-based accounting system. Accordingly, Yermack states that a company that has an accounting and finance function based on blockchain algorithms, offers an infrastructure for both the internal and external stakeholders to access financial statements at any time [15]. Such an infrastructure eliminates the need to wait for the announcement of periodic financial reports. In this respect, the impact of blockchain on accounting and finance functions is directly related to the transformation in governance structure of organizations and hence, this important event is a cutting edge since the Securities Exchange Act in 1934 [16].

Whatever sector you take into consideration, the common feature of them all is that they have an accounting and finance function. Therefore, the effect of blockchain technology is observed in all sectors and economic units all around the world [8, 17]. When it comes to accounting and finance function, the first thing that comes to mind is the book recording system and the management of monetary movements. It is generally accepted that companies, that perform these two functions effectively, efficiently, and economically, will gain competitive advantage. Recently, blockchain-based algorithm has been defined as a new turning point for this competition. The main reason for this is that it reduces costs and improves the corporate functioning thanks to its distributed ledger structure that eliminates intermediaries and provides accuracy in transactions [3, 4, 6].

The benefits of blockchain technology go well beyond the cost advantage, transparency, and increased efficiency [8]. It transforms organizational culture as a fundamental tool of digital governance, especially with a perspective that forms the subject of this study. In this respect, the most important contribution of this transformation is that it changes the balance of power and promotes trust among stakeholders [9]. It is a fact that with the blockchain technology, the elements of double entry system such as debit and credit transactions, recording systems, and the balance sheet structure, which form the basis of accounting and auditing standards, become redundant [18, 19].

According to Yermack [10] and Byström [20], if a company performs all their transactions through the blockchain-based infrastructure, there will be a

permanent time stamp in every transaction. This means that the entire ledger of the company will be instantly accessible for the authorized stakeholders. Therefore, considering the accounting and finance function of such a company, the purpose, scope, and frequency of implementation of processes and transactions, and the controls and audits performed for them will need to be changed. Although digitalization and automation are being used in every field of business environment, there will always be a need for human in decision-making processes [21]. In this context, there is a similar situation for CFOs who are the top managers of the digitalized accounting and finance functions.

2.1 The strategic role of CFOs

One of the priorities of the CFO, which plays a strategic role in the corporate structure, is to create the fundamental building blocks of a strong, stable, and reliable financial functioning for a company [22]. In general, what is expected from a CFO is to perform an accurate and secure analysis of financial data by providing data reliability with an approach that adopts an advanced level of security.

It is important to have clean, reliable, and consistent data required for financial analysis and financial reporting, which are among the main responsibilities of accounting and finance functions. A great deal of effort is put to ensure that the data is accurate and reliable. This great effort put is considered a significant cost item for businesses as well as a risk factor that has the power to affect reputation [23].

Blockchain technologies for reliable financial analysis and reporting through effective and efficient, as well as transparent and consistent data are recognized as a revolutionary contribution to the accounting and finance functions [5, 11]. In this context, the use of smart contracts offered by the blockchain-based infrastructure, can be expressed as an example of how technology can provide more reliability, assurance, and efficiency for CFOs [22].

There are various examples of blockchain applications in finance field which are discussed in detail in the relevant literature. Each of these are practices that strengthen the strategic role of the CFO and shape its agenda [4, 8]. In the **Figure 1**, based on the main articles of this survey, the areas where the block chain is used for improving the strategic role of CFO and the accounting and finance function are summarized.

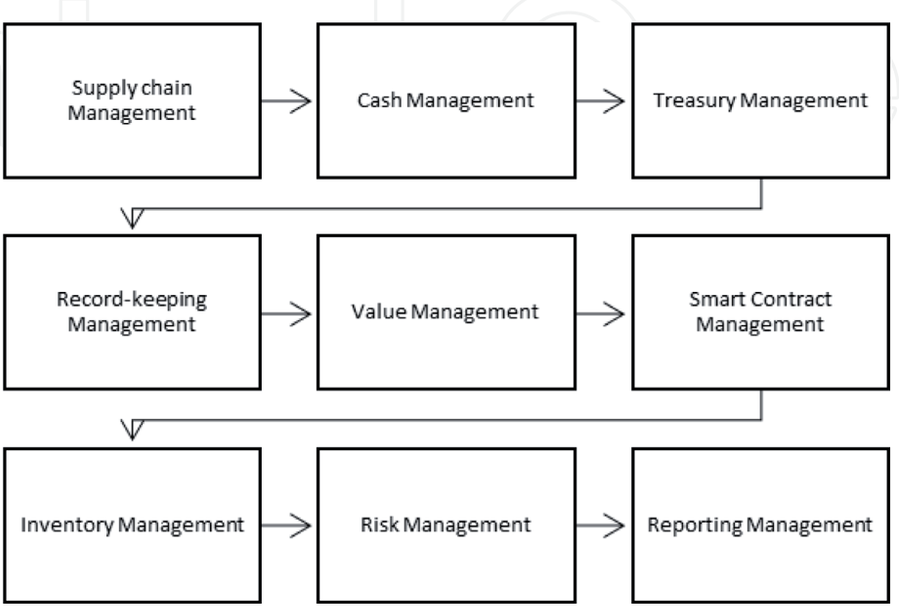

Figure 1.
Use-cases of blockchain in accounting and finance functions. Source: Compiled by the authors.

Firstly, blockchain ensures the end-to-end visibility in the supply chain management process [8, 21]. With the help of blockchain, it increases the quality of record keeping and reduces costs by ensuring the reliability and consistency of the data of all units that are related to finance. In this way, all business units are integrated via blockchain as considering "single source of true data" [24].

With untouched transactions and money transfers, the cash flow management of a company is realized with low cost and protected against misuse and fraud risks [5, 17, 24]. It should be noted that blockchain is the genesis of trust, which is not rely on any central party and distributed to the participants in a network. However, effective results are obtained when blockchain applications are supported by artificial intelligence in a wide variety of areas such as smart contract management, inventory management and treasury management [17, 25]. Thus, a solid reporting management supported by above mentioned process management and controls starting with reliable data entry based on the blockchain is achieved [24, 25]. This is the guide for the entire board of directors, and stakeholders of the company under the strategic leadership of the CFOs.

2.2 The restructuring process of accounting and finance functions

The most basic feature of a blockchain is that it simplifies the way people or businesses transact [2, 7, 11]. For this, there is an online general ledger that uses data in the blockchain infrastructure. It helps users to manage the trading book of all transactions made securely and without the contribution or intervention of a third party [1, 5]. The implementation of the innovative structure of the blockchain that simplifies the system, makes it transparent and reduces costs, means the restructuring of businesses using this type of infrastructure. In order for this restructuring to be effective and efficient i.e., "business process optimization (BPO)" [23], the business model [12] must be transformed, depending on blockchain technologies [7].

It is a fact that the blockchain-based algorithms contain a complete history of every transaction. Notwithstanding there are important advantages of blockchain technology, there are also issues that still await research [23, 26]. For example, although sensor data received in a blockchain application can be verified, it is not possible to identify data that has been manipulated in the "off-chain environment" [5, 7], that is, previously corrupted. Therefore, the way to reliably process blockchain algorithms is to determine the techniques to detect corrupted data incoming to the ledger before processing and posting [27].

3. Blockchain algorithm samples in the field of accounting, finance, and auditing

In this section, the data, methodology and the key findings are explained respectively as follows. Although the main subject of this study is to investigate the impact of blockchain on accounting and finance, an approach that includes the auditing of these areas, constitutes a more appropriate scope. In particular, the primary field of internal audit, internal control, and risk management in the literature is mostly based on analysis of the effectiveness of accounting and finance functions [9, 18, 28]. Therefore, digital transformation process necessitates the use of digital auditing and monitoring techniques in the governance of these functions. In this respect, expanding the scope by including auditing in the survey, becomes a common intersection point for our work to make more accurate policy recommendations.

3.1 Data and methodology

In this study, bibliometric method is used for executing the survey on blockchain algorithms in the field of accounting, finance, and auditing. In this respect, both VOSviewer [13] and R programs [14] are used, respectively. Bibliometric methods help to examine scientific studies from a diverse perspective by applying statistical analysis for books, articles, and other publications [29]. With this method, researchers are given the opportunity to move from "micro focus" to "macro focus" [30]. Thus, the researchers could examine and interpret the dynamics of the field they are studying with a broad perspective. As a result of the bibliometric network analysis made, inferences are obtained regarding various patterns of authors, documents, and countries [31]. The basic work steps of this analysis are shown in the **Figure 2** below:

The filtering words used to find relevant publications from the web of science (WOS) database are as follows: "Blockchain", "Algorithms", "Accounting", "Finance", "Digital Auditing", "Auditing", and "Artificial Intelligence". There are (435) relevant articles obtained from the WOS. Since the discovery of blockchain has been a recent event, the survey period is intentionally chosen for the period 2005–2021. In this respect, after applying the basic steps in **Figure 2**, the mapping is formed by VOSviewer which is shown in **Figure 3**. The bibliometric network analysis findings are explained and discussed in the below section.

When the filtering area on the web of science is set as "blockchain" only, over a million articles are listed. However, when other keywords are added together with the blockchain by making the field specific and analyzed at the same time, the number decreases considerably as shown in **Figure 3**. Accordingly, the findings are obtained and discussed as follows.

3.2 Discussion on the bibliometric findings

The findings of the bibliometric network analysis are summarized based on "Co-citation" aspects for the period 2005–2021 considering the SSCI indexed articles. In bibliometric network analysis, a total of (6) basic clustering structures have emerged. Hence, there are basically (39) items, (6) clusters, (200) links and (469) strength of the "Co-citation" mapping. The keywords that make up these clusters are presented in Appendix A and findings are discussed as follows:

3.2.1 Cluster 1: finance

The first set of bibliometric network analysis reveals a strong interaction between blockchain and finance. In the literature, it has been determined that the

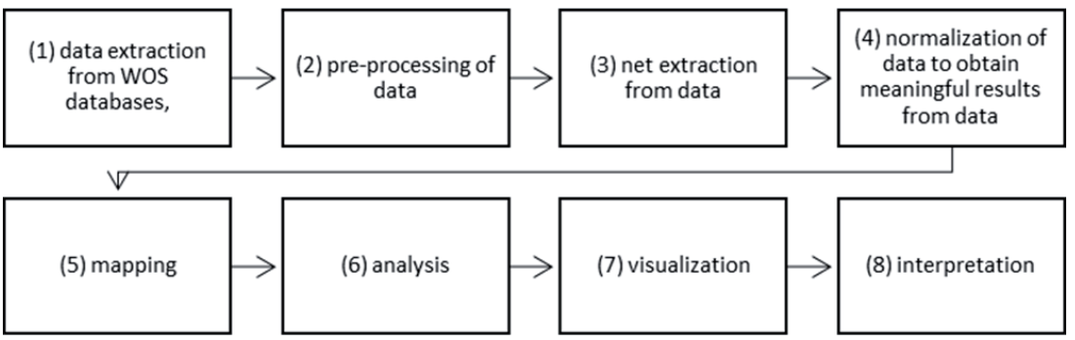

Figure 2.
The basic steps of bibliometric network analysis. Source: [31, 32].

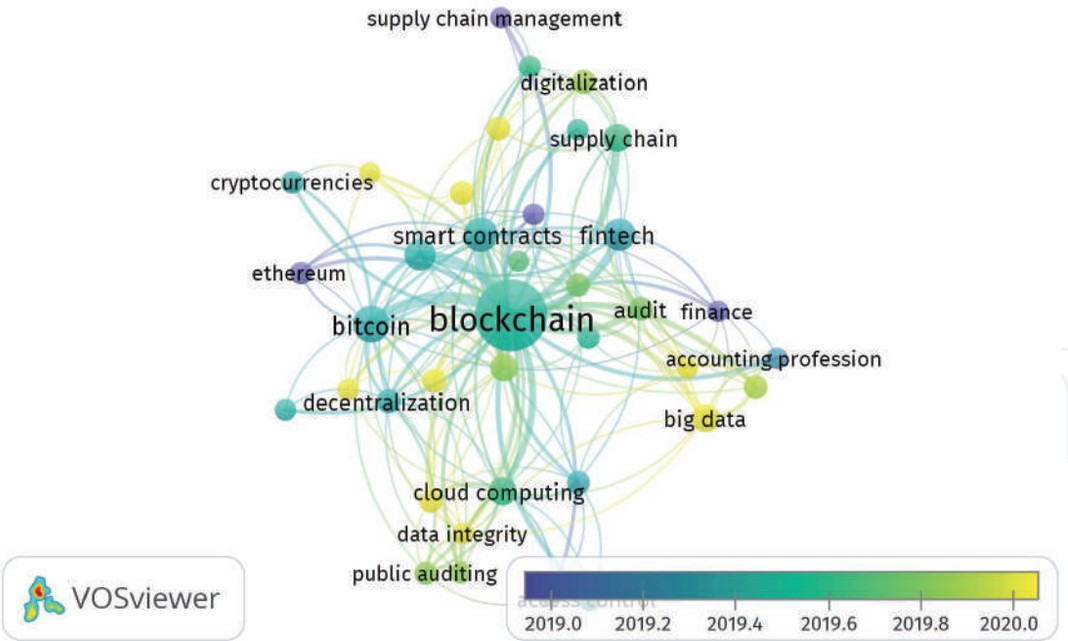

Figure 3.
Bibliometric network of Blockchain, accounting, auditing and finance. Source: [13].

other keywords, that are mainly considered together with finance and blockchain, are "accounting profession", "artificial intelligence", "audit", "big data", "internet of things" and "machine learning". This means, it can be stated that the perspective of the "accounting profession" has changed with "fintech" in the financial sector. In addition, "machine learning", "big data", "internet of things", and "artificial intelligence" are shown as the main source of this change. The point to note here is that the keyword "audit" has been processed in terms of the private sector within this cluster. However, the scope of "public auditing" in Cluster 2 within the context of auditing, mainly deals with compliance auditing and tax regulations relevant for public sector.

3.2.2 Cluster 2: public auditing

In bibliometric network analysis of the Cluster 2, the keywords are presented as "access control", "cloud computing", "cloud storage", "data integrity", "data privacy", and "privacy" respectively. Hence, it is understood that the scope and purpose of blockchain applications in the public sector differ from those of the private sector. Here, it can be stated that especially prominent keywords give priority to the purpose of making the legislative harmonization process in public business processes safe and confidential. At the same time, it is observed that data security and data storage conditions are the main areas of discussion to reveal the social benefit in the digitalization process.

3.2.3 Cluster 3: blockchain

In Cluster 3, there are keywords such as "digitalization", "distributed ledger technology" and "traceability", which are directly related to the blockchain implementation process and can be considered an integral part of the technical characteristics of blockchain. On the other hand, the key words defining the "supply chain management", "supply chain finance", and "smart contracts" applications that stand out among the sectoral best practices, are also included in the list.

3.2.4 Cluster 4: accounting

Keywords in this cluster, which are closely related to accounting, can be expressed as "auditing", "blockchain technology", "permissioned blockchain" and "security" respectively. Accounting and "auditing" are generally regarded as intertwined practices. One of the primary audit areas in auditing in the literature is financial statements and financial management processes. Therefore, the keywords given in this cluster as "blockchain technology", "permissioned blockchain" and "security" are also supportive of the current situation of accounting profession and related findings in the literature.

3.2.5 Cluster 5: bitcoin

When it comes to blockchain, "bitcoin" comes to mind first. The keywords associated with bitcoin such as "crowd funding", "cryptocurrency" and "Ethereum" are clearly monitored in this cluster. In the literature, developments that are closely related to accounting and finance, especially covering these keywords, are discussed. "Crowd funding", which has the potential to change the corporate functioning of accounting and finance, can be given as an important example among these clusters.

3.2.6 Cluster 6: consensus algorithm

The consensus algorithm is a concept that is closely related to the blockchain. This concept is considered widespread as to be mapped under a separate cluster within this bibliometric network analysis. In addition, there are other important and related keywords which are as follows: "decentralization", "distributed ledger", "peer to peer computing", and "smart contract".

The "Conceptual Structure Map" based on the correspondence analysis method is performed by using R program and the findings are presented in **Figure 4**. This analysis is performed by using R code, namely "bibliometrix" package with BiblioShiny App which is used for "performing bibliometric analysis and building

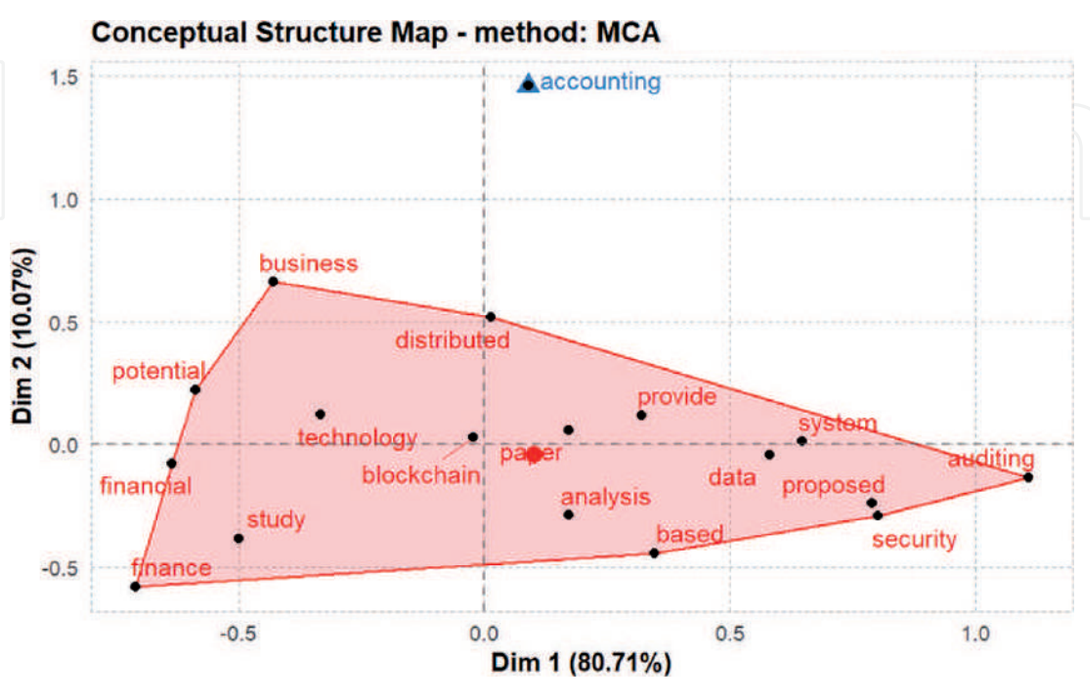

Figure 4.
Conceptual structure map of Blockchain, accounting, auditing and finance. Source: [14].

data matrices for co-citation, coupling, scientific collaboration analysis and co-word analysis" [14]. In this respect, **Figure 4** can be seen as the big picture concerning the blockchain in the literature and hence, based on the block chain and related concepts that are the subject of bibliometric network analysis, it is stated in the literature that there will be considerable technological developments that deeply affect accounting, finance, and audit processes.

The prominent and top (10) journals, in which these studies were conducted, are given below in **Figure 5**. For instance, the first journal in the list is "COMPUTER SCIENCE INFORMATION SYSTEMS" and the second is "BUSINESS FINANCE". Accordingly, it is seen that journal structures are interdisciplinary and the whole list is presented in Appendix B.

Looking at the development of the literature on blockchain over the years, it is predicted that a significant acceleration has been observed in 2020 and this will increase further in the coming years. This situation is clearly monitored in the **Figure 6**.

In addition, it has been determined that China is by far the first among the contributing countries among the top (20) countries. This is true for China in the case of both single and multiple country publications. This is presented in **Figure 7**. The countries included here are generally similar to the G20 countries. However, it

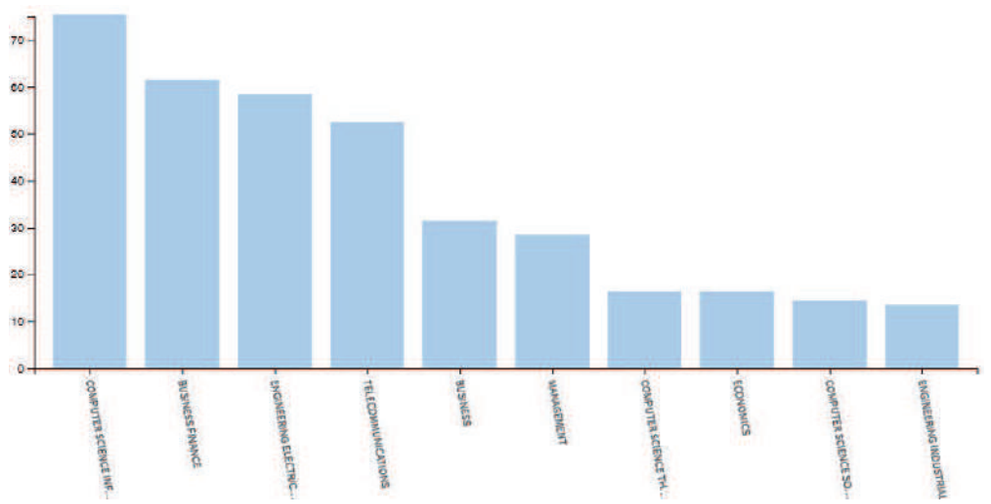

Figure 5.
Top 10 journals related to the bibliometric network survey. Source: [13].

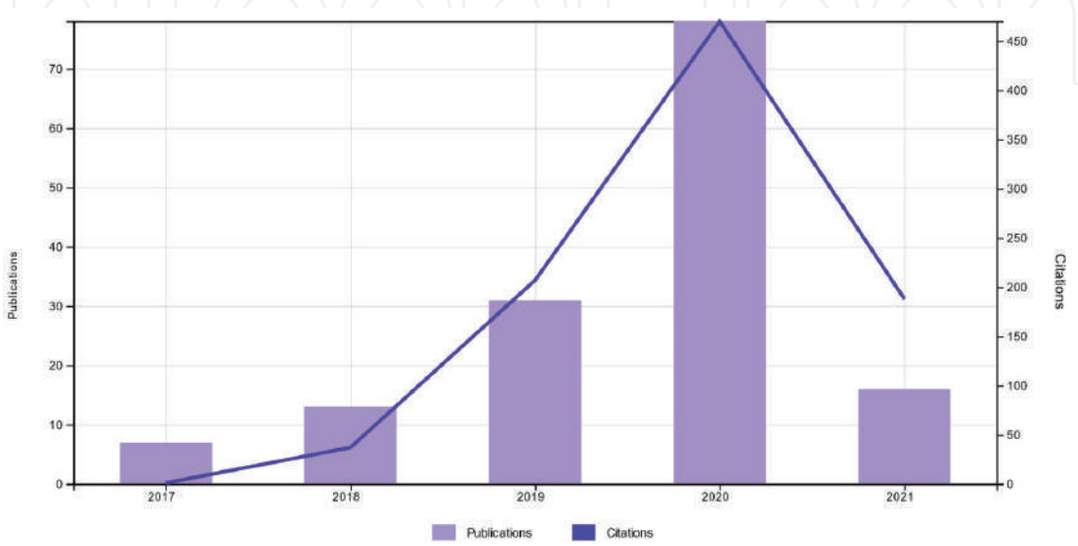

Figure 6.
Publications and citations related to Blockchain (2005–2021). Source: [13].

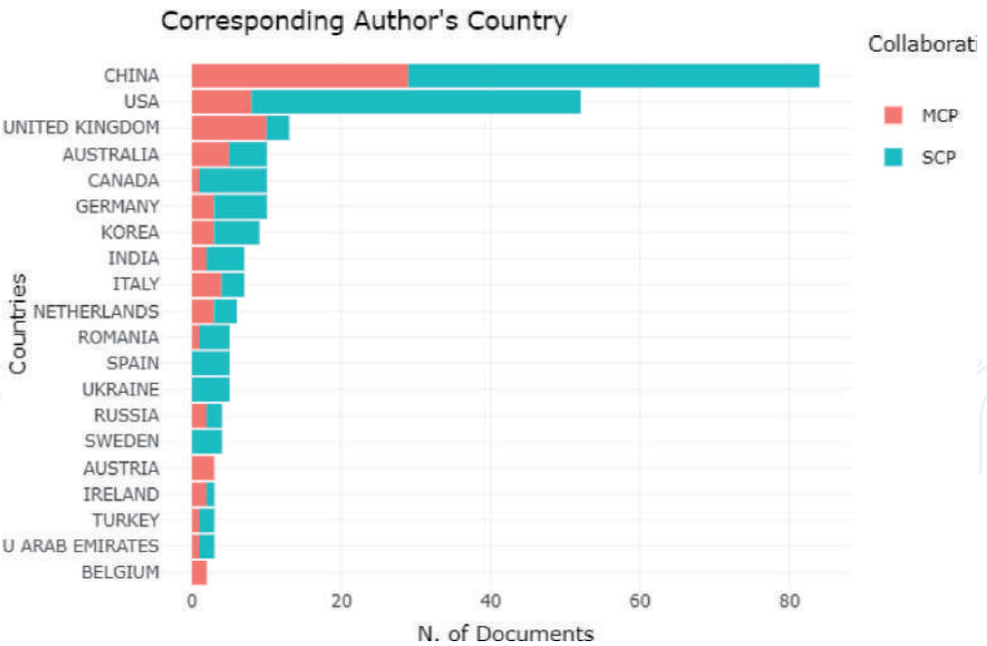

Figure 7.
The list of top 20 corresponding Author's country. SCP: Single country publications (intra country collaboration); MCP: Multiple country publications (inter country collaboration). Source: [14].

can be stated that there is no ranking proportional to their economic size. China is by far the top three, followed by the USA and the UK. This situation indicates that China, the USA and the UK will be the countries producing technology and determining innovation policies in the future.

4. Concluding remarks

In this study, the developments in the literature in the field of accounting, finance and auditing with block chain algorithms were investigated through bibliometric network analysis. According to the findings obtained by using VOSviewer and R program for this analysis, the development areas seen in the literature are collected under six basic clusters. When the interaction areas within these clusters are examined, the first is; It can be stated that private sector and public sector distinction has emerged. Latter, it is concluded that finance, blockchain and auditing are intertwined. Third, it has been revealed that the interaction of public auditing with the blockchain differs and the data security perspective comes to the fore. Fourth, it has been determined that there is an important literature dealing with accounting, finance, auditing, and blockchain interaction. Fifth, it is revealed that a separate literature on the blockchain and bitcoin and cryptocurrencies in general has developed. This cluster gives a significant clue for the emergence of new financial instruments in the near future. Sixth, since the blockchain is based on algorithms, it has been demonstrated that algorithmic applications have evolved significantly to the extent of being located in a separate cluster.

In this context, it is concluded that the three countries, that contribute the most to the literature, have the power to determine the areas of change in the fields of accounting, finance, and audit in the future. These countries are China, USA, and the UK respectively, and the ranking is evaluated in accordance with the expectations within the framework of general economic standards and approaches.

While this survey is a pioneering work, the limitations arising from the current state of the blockchain are also worth mentioning. There is a need for standardization of the blockchain. When this structure is standardized, it may be possible for it to become widespread and to be more accepted in the field of finance. Since the

blockchain is not yet subject to generally accepted legal regulations, it may cause difficulties in registration and valuation processes in the financial field. Difficulties may also arise if the consensus lead time on the blockchain is prolonged. Therefore, it would be appropriate to cooperate at international level on blockchain-related issues in order to use resources effectively.

Conflict of interest

"The authors declare that there is no conflict of interest."

Appendix A. Bibliometric Network Analysis-Mapping of Co-citations Clusters (2005–2021)

Cluster 1 (8 items)	Cluster 2 (8 items)	Cluster 3 (8 items)	Cluster 4 (5 items)	Cluster 5 (4 items)	Cluster 6 (5 items)
Finance	Public auditing	Blockchain	Accounting	Bitcoin	Consensus algorithm
Accounting profession	Access control	Digitalization	Auditing	Crowd funding	Decentralization
Artificial intelligence	Cloud computing	Distributed ledger technology	Block chain technology	Cryptocurrency	Distributed ledger
Audit	Cloud storage	Smart contracts	Permissioned blockchain	Ethereum	Peer to peer computing
Big data	Data integrity	Supply chain finance	Security		Smart contract
Fintech	Data privacy	Supply chain management			
Internet of things	Data sharing	Traceability			
Machine learning	Privacy				

B. List of Top 10 Journals

1. Computer Science Information System
2. Business Finance
3. Engineering Electrical Election
4. Telecommunications
5. Business
6. Management
7. Computer Science Theory Methods

8. Economics

9. Computer Science Software Engineering

10. Engineering Industrial

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References

[1] Potekhina A, Riumkin I, Blockchain – a new accounting paradigm Implications for credit risk management: Umeå School of Business and Economics, 2017, [Master degree thesis].

[2] Nakamoto, S. Bitcoin: A Peer-To-Peer Electronic Cash System; CoinDesk: New York, NY, USA, 2008, . 1-9.

[3] Kokina, J., Mancha, R. and Pachamanova, D., Blockchain: emergent industry adoption and implications for accounting: Journal of Emerging Technologies in Accounting, 2017, Vol. 14 No. 2, pp. 91-100.

[4] Calderon, M., Lawrence, S. and Churchil, S. Distributed ledgers: a future in financial services? : Journal of International Banking Law and Regulation, 2016, Vol. 31 No. 5, 246-247.

[5] Dai, J., Vasarhelyi, M.A., Toward blockchain-based accounting and assurance: Journal of Information System, 2017, 31, 5-21.

[6] Alarcon, J.L. and Ng, C., Blockchain and the future of accounting: Pensylvania CPA Journal, 2018, Vol. 88 No. 4, pp. 26-29.

[7] I.-C. Lin and T.-C. Liao, A survey of blockchain security issues and challenges: International Journal of Network Security, 19, 2017, 653-659.

[8] Avdzha A. K. The Coming Age of Blockchain Technology in Corporate Governance: LLM International Business Law, [Master's Thesis], 2017, Under the supervision of Ivona Skultetyova, Available from: http://arno.uvt.nl/show.cgi?fid=143457

[9] Singh, H., Jain, G., Munjal, A. and Rakesh, S. Blockchain technology in corporate governance: disrupting chain reaction or not?: Corporate Governance, 2019 Vol. 20 No. 1, 67-86. https://doi.org/10.1108/CG-07-2018-0261

[10] Yermack, D., Corporate governance and blockchains: National Bureau of Economic Research, Working Paper No. w21802, 2015, available at: www.nber.org

[11] Fanning, K.; Centers, D.P., Blockchain and its coming impact on financial services: Journal of Corporate Accounting and Finance, 2016, 27, 53-57.

[12] Morkunas, V.J. Paschen, J. Boon, E. How blockchain technologies impact your business model: Business Horizon, 2019, 62, 295-306.

[13] VOSviewer 1.6.16 program, 2021: available at: https://www.vosviewer.com/

[14] R program, 2021: available at : https://www.bibliometrix.org/ and https://rdrr.io/cran/bibliometrix/man/conceptualStructure.html

[15] Yermack D, Corporate Governance and Blockchains: Review of Finance, Volume 21, Issue 1, March 2017, 7-31, doi/10.1093/rof/rfw074

[16] New York Stock Exchange (NYSE), Securities Exchange Act of 1934, Available from: https://www.nyse.com/publicdocs/nyse/regulation/nyse/sea34.pdf

[17] Bozkus Kahyaoglu, S., An Analysis on the Implementation of New Approaches and Techniques in the Auditing of Business Processes Based on Blockchain Technologies: Cryptocurrencies in all aspects, Editors, Ayhan, F. and Darıcı, B. 2018, Peterlang Publications, ISBN: 978-3-631-78387-0.

[18] Westland, J. C. Audit Analytics-Data Science for the Accounting Profession: Springer Publications, 2020, ISBN: 978-3-030-49091-1, https://doi.org/10.1007/978-3-030-49091-1

[19] Makhdoom, I. Abolhasan, M. Abbas, H. Ni, W. Blockchain's adoption

in IoT: The challenges, and a way forward: Journal of Network Computer Applications. 2019, 125, 251-279.

[20] Byström H., Blockchains, Real-Time Accounting and the Future of Credit Risk Modeling: Lund University Working Paper, 2016, 43-5.

[21] Wang, Huaiqing, Kun Chen, and Dongming Xu., A Maturity Model for Blockchain Adoption: Financial Innovation, 2016, 2, 12.

[22] KPMG, Blockchain and the future of finance, A potential new world for CFOs—and how to prepare, 2019, available at: https://assets.kpmg/content/dam/kpmg/ca/pdf/2019/05/blockchain-and-the-future-of-finance.pdf

[23] Sandner P., Lange A., and Schulden P., The Role of the CFO of an Industrial Company: An Analysis of the Impact of Blockchain Technology: Future Internet 2020, 12, 128; doi:10.3390/fi12080128

[24] Deloitte, How CFOs Can Use Blockchain to Drive Value for Finance: CFO Journal, 2018, with contribution of Terence Lam, a consultant in Deliotte: available at: https://deloitte.wsj.com/cfo/2018/09/18/how-cfos-can-use-blockchain-to-drive-value-for-finance/

[25] Singh, M., Blockchain Technology for Corporate Reporting: An Investor Perspective: CFA Institute Position Paper, available at: https://www.cfainstitute.org/-/media/documents/article/position-paper/cfa-blockchain-wp_text.ashx

[26] Hughes, L., Dwivedi, Y.K. Misra, S.K. Rana, N.P. Raghavan, V. Akella, V., Blockchain research, practice and policy: Applications, benefits, limitations, emerging research themes and research agenda: International Journal of Information Management, 2019, 49, 114-129.

[27] Risius, M. Spohrer, K., A blockchain research framework: What we (don't) know, where we go from here, and how we will get there: Business Information System Engineering, 2017, 59, 385-409.

[28] Zhang Yingying, Xiong Feng, Yi Xie, Fan Xuan, And Haifeng Gu, The Impact of Artificial Intelligence and Blockchain on the Accounting Profession: IEEE Access, 2020, Volume 8, available at: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9110603

[29] Oxford Dictionary, 2021, available at: https://www.lexico.com/definition/bibliometrics

[30] Zupic, I., Bibliometric methods in management and organization: Organizational Research Methods, 2015, 18, 3, 429-472.

[31] Martinez M. A., Cobo, M. J., Herrera, M., Enrique Herrera-Viedma, Analyzing the scientific evolution of social work using science mapping: Research on Social Work Practice, 2015, 25, 257-77.

[32] Chen, C., Science mapping: a systematic review of the literature: Journal of Data and Information Science, 2017, 2, 2, 1-40.

Chapter

Analysis of Return and Risk of Cryptocurrency Bitcoin Asset as Investment Instrument

Sunita Dasman

Abstract

This study aims to explore the potential use of the cryptocurrency bitcoin as an investment instrument in Indonesia. The return obtained from bitcoin cryptocurrency is compared to other investment instruments, namely stock returns, gold and the rupiah exchange rate. The research period was carried out based on research data from 2011 to 2020. This study employee compares means test (t test) and analysis of variance (F test) on rate of return of bitcoin investment. The bitcoin return compare to the rate of return form the others investments instruments namely exchange rate, gold and stock. The study collected 120 data of each investments instruments: bitcoin, exchange rate, gold and stock from various of sources during 2011–2020. Then, we calculate the return and risk of individual investment instruments. The results showed that the bitcoin currency had the highest rate of return 18% with a standard deviation of 61% compared to exchange rate, gold and stock returns. While the rate of return for the others investment instruments showed less than 0.5% with standard deviation less than 5%. The rate of return bitcoin has significance difference compare to the rate of return of exchange rate, gold and stock. The study contribute for the investors who would like to invest on bitcoin. The investors should understand the characteristic of bitcoin in term of rate of returns and also the risk. This study also contributes to government of Indonesia on crypto currency development. The Indonesia government should adopt and regulate on crypto currency in the future to secure the investor and economic growth.

Keywords: Cryptocurrency, bitcoin, stocks, gold, exchange rate

1. Introduction

As cryptocurrencies become popular and market places for cryptocurrencies are growing rapidly. Understanding the rate of return can support cryptocurrency world is and how design choices affect investors. One threat to cryptocurrencies is high fluctuations in traders' willingness to buy or sell [1]. The adoption of crypto assets has been a great concern for policy makers ever since Facebook announced its cryptocurrency, Libra, in June 2019 [2].

The technology behind these cryptocurrencies, a decentralized and open-source system named "blockchain" is often presented as one of the most innovative technology offering several many disruptive innovations in the next years [3–6]. The crypto-currencies trading volume also has a granger-causality to energy

consumption [7]. A crypto asset is an intangible digital asset whose issuance, sale or transfer are secured by cryptographic technology and shared electronically via a distributed ledger [8].

The era of digitalization of technology has given birth to the cryptocurrency Bitcoin (BTC) as a new exciting currency for the world community, including Indonesia. BTC is an alternative to complement the needs of global financial transactions that want convenience, efficiency and security. Use of the digital computing tools to process scientific, economic, and social information has changed the human capacity, considerably. Virtual space is being activated year over year being the result of efficient application of information resources [9].

The development of BTC is very rapid in Indonesia. Indonesia, which has a total population of 271,349 889 people in 2020 (BPS, 2021). The population of Indonesia is very potential for the growth of the investment climate for BTC.

Almost all countries in the world experienced a decline in economic growth in 2020 due to the 19 virus pandemic. However, BTC price growth showed a very significant increase in 2020. BTC prices recorded the best performance since 2013 amounting to 260 USD / BTC. The price of BTC is USD 12,310 in 2020 or an increase of 68.04% compared to 2019 amounting to USD 7,326 / BTC (investing, 2021). **Table 1** shows the development of the value of BTC (USD / BTC) in 2010–2020.

Variable	Indicator	Measurement	Type of data	Source
Stock	Indonesia Composite Index	Average Stock Price/ Baseline*	Ratio	www.investing.com
Exchange Rate	Convert from USD to IDR currency	IDR/USD	Ratio	www.investing.com
Gold	Gold price in USD per 1 Troy Ounce	USD/Troy Ounce	Ratio	www.harga-emas.org
Bitcoin	Bitcoin price in USD per Bitcoin	USD/BTC	Ratio	www.investing.com

*Source: various sources, 2021.*The baseline used to calculate the composite stock price index is the average price of the shares on August 10, 1982.*

Table 1.
Operational variable.

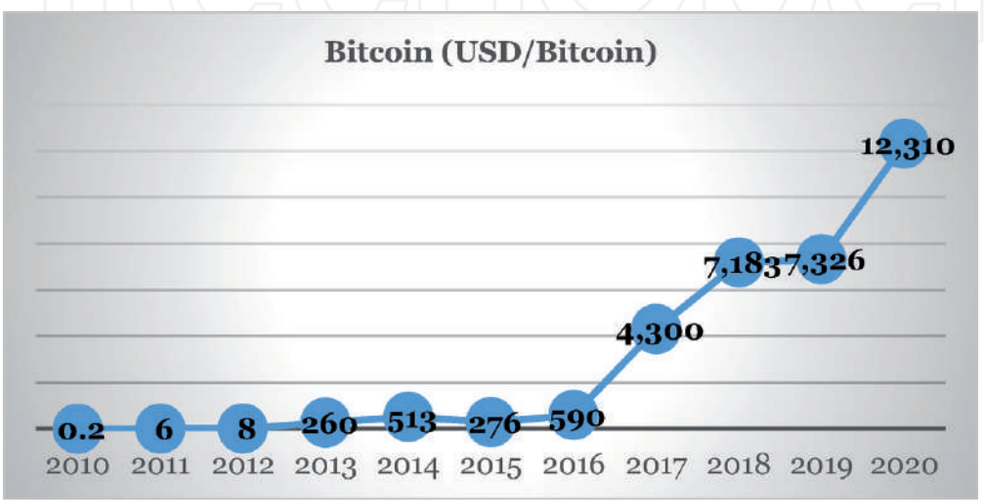

Figure 1.
Bitcoin cryptocurrency graph 2010–2020 (USD/BTC). Source: www.investing.com, 2021.

Indonesians who start investing in bitcoin currency can change the existing financial asset structure. The development of bitcoin currency in Indonesia can disturb the stability of the rupiah as the only valid currency for domestic transactions. Therefore, Bank Indonesia as the determinant of monetary policy has not or has not legalized bitcoin currency as a virtual currency in Indonesia.

This research aims to examine bitcoin cryptocurrency as an investment instrument opportunity compared to other investment instruments, namely stocks, gold and the rupiah exchange rate. For the government as policy makers, this research is expected to be an input for the development of digital currency in the era of information technology. In addition, for investors, this research is expected to illustrate the returns and risks faced when investing in bitcoin (**Figure 1**).

2. Literature review and hypothesis development

The study and analysis of the cryptocurrency market is a relatively new area. A few works published in recent years have had the potential interest in this topic. Many scientists have been studying Bitcoin from different angles ever since it appeared. Cryptocurrency is a digital currency, whose creation and control is based on cryptographic methods. Some researchers claim that Bitcoin is just a bubble. The fundamental value of Bitcoin is difficult to reveal, and history shows that innovative assets are indeed more prone to bubbles [10].

Bitcoin is the first decentralized peer-to-peer payment network that is fully controlled by its users without any central authority or intermediary. Bitcoin is a digital currency residing in an open source P2P (peer-to-peer) payment network. P2P is a computer network model that consists of two or more computers, where each computer in the network environment can share. This network makes it easy for users to transact directly without the need for services from third parties.

The elements of Bitcoin are the existence of a peer-to-peer network, blocks, blockchain, and miners. The peer-to-peer network in Bitcoin allows users to transfer a certain amount of Bitcoin value, these transactions are stored in files called blocks, these blocks are intertwined with each other to form a block chain called the blockchain, and miners solve complex mathematical formulas. to prove ownership of Bitcoin.

Bank Indonesia responds to the existence of Bitcoin if it can be used, traded, or stored as an asset or a form of digital commodity by the people of Indonesia, but it cannot be used as a means of payment because only the Rupiah currency is the only legal means of payment in Indonesia.

Bitcoin is the first implementation of the concept of cryptocurrency, which was first described by Wei Dai in 1998. The proposes of cryptocurrency is a new form of money that uses cryptography to control creation and transactions rather than using a centralized authority.

Cryptocurrency is a digital asset designed to function as a medium of exchange that uses strong cryptography to secure financial transactions, control the creation of additional units, and verify asset transfers.19 Cryptocurrency is a type of alternative currency and digital currency. Cryptocurrencies use decentralized controls compared to centralized digital currencies and central banking systems.

Cryptocurrency is a virtual currency that circulates without being regulated by a particular central bank, is not "backed up" with gold as currency, and is not protected by any particular country. Distribution and use through the internet network media. With this crypto many benefits are obtained without exchanging it for real money, the value of crypto prices has international standards so that the value is the same everywhere, the transfer time is very fast, and crypto is not owned

by a particular company. Crypto is a digital asset where transactions are carried out using an online network. Crypto assets are virtual so if one wants to see what the physical form of this currency is, then the answer is no. The form is not like a physical currency issued by a bank and also not the currency of a country.

Investors can maximize asset allocation through a combination of risky assets to reduce high risk. Investors who have an aversion to risk tend to reject investments that are more likely to have speculative content. Investors who do not like risk consider risk-free investments or speculate on investments that have a positive premium.

Research related to virtual currency, especially bitcoin cryptocurrency, is still rarely done in Indonesia. However, the development of bitcoin cryptocurrency has recently begun so that further studies are needed to provide an overview to the public and policy makers regarding bitcoin cryptocurrency investment. Some of the research results that have been carried out both domestically and globally can be summarized as follows:

Voskobojnikov et al. [11] identified and qualitatively analyzed 6,859 reviews pertaining to the user experience with top five mobile cryptocurrency wallets. They suggested that both new and experienced users struggle with general and domain-specific user experience issues that, aside from frustration and disengagement, might lead to dangerous errors and irreversible monetary losses. They reveal shortcomings of current wallet user experience as well as users' misconceptions, some of which can be traced back to a reliance on their understanding of conventional payment systems. Based on their findings, they provide recommendations on how to design cryptocurrency wallets that both alleviate the identified issues and counteract some of the misconceptions in order to better support newcomers.

Hachicha and Hachicha [12] proved the efficiency of Markov Chain for our sample and the convergence and stability for all parameters to a certain level. On the whole, it seems that permanent shocks have an effect on the volatility of the price of the bitcoin and also on the other stock market. Our results will help investors better diversify their portfolio by adding this cryptocurrency.

Mikhaylov, A. [10] conclude that the cryptocurrency market has entered a new stage of development, which means a reduced possibility to have excess profits when investing in the most liquid cryptocurrencies in the future. However, buying new high-risk tools provides opportunities for speculative income.

Igoni et al. [13] concluded that market capitalization and volume of digital currency did not constitute the significant variables of policy to influence the monetary policies in the South African economy, hence they operate independently. A decision to adopt and regulate digital currency operation or not in Nigeria does not affect. They recommend the Nigerian to embrace the digital environment in terms of regulations for tax advantage.

Le Tran and Leirvik [14] shown that the level of market-efficiency in the five largest cryptocurrencies is highly time-varying. Specifically, before 2017, cryptocurrency-markets are mostly inefficient. This corrobo-rates recent results on the matter. However, the cryptocurrency-markets become more efficient over time in the period 2017–2019. This contradicts other, more recent, results on the matter. The reason is that they apply a longer sample than previous studies. Another important reason is that they apply a robust measure of efficiency, being directly able to determine if the efficiency is significant or not. On average, Litecoin is the most efficient cryptocurrency, and Ripple being the least efficient cryptocurrency.

Agosto and Cafferata [15] found that extremely rapid price accelerations, often referred to as explosive behaviors, followed by drastic drops pose high risks to investors. From a risk management perspective, testing the explosiveness of individual cryptocurrency time series is not the only crucial issue.

Rabbani et al. [16] identified that the sharia compliance related to the cryptocurrency/Blockchain is the biggest challenge which Islamic Financial Technology organizations are facing. During our review we also find that Islamic Financial Technology organizations are to be considered as partners by the Islamic Financial Institutions (IFI's) than the competitors. If Islamic Financial institutions want to increase efficiency, transparency and customer satisfaction they have to adopt Financial Technology and become partners with the Financial Tech companies.

Hairudin et al. [17] indicated that public embrace of cryptocurrencies continues to lag as the masses currently show reluctance in embracing cryptocurrencies as a complement, let alone a substitute to fiat counterparts. Governments have also successfully defended their sovereignty in preserving legal tender status, structural seignior age and exclusivity. Market-based studies hint at consistent inefficiencies across the spectrum. The most promising areas of research for crypto-financial intelligentsia would be delving into establishing trial runs for central bank-backed cryptocurrencies.

Grobys et al. [18] indicated that a variable moving average strategy is successful when using the 20 days moving average trading strategy. Specifically, excluding Bitcoin the technical trading rule generates an excess return of 8.76% p.a. after controlling for the average market return. The results suggest that cryptocurrency markets are inefficient.

Amsyar et al. [19] concluded that cryptocurrency has the disadvantage of not having the authority responsible for dealing with all problems that occur in all transactions, and money laundering crimes also often occur, this is a challenge for how to utilize cryptocurrency and blockchain technology in the current era of globalization.

Vaz de Melo and Fluminense [20] indicated that indicate that the strength of dependence among the crypto-currencies has increased over the recent years in the cointegrated crypto-market. The conclusions reached will help investors to manage risk while identifying opportunities for alternative diversified and profitable investments.

Tu et al. [21] detected two sudden jumps in the standard deviation, in the second quarter of 2017 and at the beginning of 2018, which could have served as the early warning signals of two major price collapses that have happened in the following periods. They propose a mean-field phenomenological model for the price of cryptocurrency to show how the use of the standard deviation of the residuals is a better leading indicator of the collapse in price than the time-series' autocorrelation. Their findings represent a first step towards a better diagnostic of the risk of critical transition in the price and/or volume of crypto-currencies.

Fang et al. [22] summarized the existing research papers and results on cryptocurrency trading, including available trading platforms, trading signals, trading strategy research and risk management. This paper provides a comprehensive survey of cryptocurrency trading research, by covering 126 research papers on various aspects of cryptocurrency trading (e.g., cryptocurrency trading systems, bubble and extreme condition, prediction of volatility and return, crypto-assets portfolio construction and crypto-assets, technical trading and others). This paper also analyses datasets, research trends and distribution among research objects (contents/properties) and technologies, concluding with some promising opportunities that remain open in cryptocurrency trading.

Drożdż et al. [23] found that A particularly significant result is that the measures applied for detecting cross-correlations between the dynamics of the BTC/ETH and EUR/USD exchange rates do not show any noticeable relationships. This could be taken as an indication that the cryptocurrency market has begun decoupling itself from the Forex.

Panagiotidis et al. [24] found that a significant interaction between bitcoin and traditional stock market. The increased impact of Asian markets on Bitcoin compared to other geographically-defined markets. Two years after the Chinese regulatory interventions and the sudden construction of CNY's share in bitcoin trading volume.

Aysan et al. [25] found that bitcoin can be considered as a hedging tool against global geopolitical risk.

Krafft et al. [1] found that individual "buy" actions led to short-term increases in subsequent buy-side activity hundreds of times the size of our interventions. From a design perspective, we note that the design choices of the exchange we study may have promoted this and other peer influence effects, which highlights the potential social and economic impact of HCI in the design of digital institutions.

Panagiotidis et al. [26] found that search intensity and gold returns emerge as the most important variables for bitcoin returns.

Koutmos [27] found that the contribution of return shocks to transaction activity is quantitatively larger in magnitude.

Demir et al. [28] found that bitcoin can serve as a hedging tools again uncertainty.

Balcilar et al. [29] found that non-linear relationship between bitcoin returns and trading volume. The trading volume cannot help to predict the volatility of returns at any point of the conditional distribution.

Urquhart [30] found that bitcoin return significantly inefficient but in the process of moving towards an efficient market.

Based on the research objectives, the researcher wants to compare the returns obtained from bitcoin currency and others investment instrument, namely stocks, exchange rates and gold to see how rate of return behavior on bitcoin currency. Besides measure rate of return on bitcoin currency, the researcher also measures the risk of bitcoin currency investment. Standard deviation of bitcoin currency employee to measure the risk of the investment. Thus, the statistical hypotheses and research hypotheses used in this study are as follows:

Ho1: $\mu_1 = \mu_2$.
Ha1: $\mu 1 \neq \mu 2$.
Ho2: $\mu 1 = \mu 3$.
Ha2: $\mu 1 \neq \mu 3$.
Ho3: $\mu 1 = \mu 4$.
Ha3: $\mu 1 \neq \mu 4$.
Ho4: $\mu_1 = \mu 2 = \mu 3 = \mu 4$.
Ha4: At least one of the average returns are not equal.
where:
$\mu 1$ = average bitcoin returns.
$\mu 2$ = average exchange rate returns.
$\mu 3$ = average gold returns.
$\mu 4$ = average stock returns.

While the research hypothesis developed in this study is as follows:

H01: There is no difference between the bitcoin returns and the exchange rate returns.

Ha1: There is a difference between the bitcoin returns and the exchange rate returns.

H02: There is no difference between the bitcoin returns stock and the gold returns gold.

Ha2: There is a difference between the bitcoin returns and the gold returns.

H03: There is no difference between the bitcoin returns and the stock returns.

Ha3: There is a difference between the bitcoin returns and the stock returns.

H04: There is no difference between the bitcoin returns and the others investment instrument.

Ha4: There is a difference between the bitcoin returns and the others investment instrument.

3. Methodology

This study compares the return and risk of bitcoin, stocks, gold and the rupiah exchange rate. This research is a type of quantitative research using secondary data. Secondary data used in the study were obtained from www.investing.com [31]; for bitcoin and share prices. Gold prices were obtained from www.harga-emas.org [32]; Rupiah exchange rate is obtained from www.bi.go.id [33]. The research period from 2010 to 2020 used monthly data or 132 observed data.

The return calculation uses the formula for the difference from the current value to the previous value divided by the value in the previous period. In general, the return formula can be written as follows:

$$\text{Return} = \frac{R_{t-}R_{t-1}}{R_{t-1}} \tag{1}$$

where:

R_t = the return at period t.

R_{t-1} = the return at period t−1.

In this study also measure risk of each investment instruments. Standard deviation is employed to measure the risk of investments. Standard deviation to measure how far the deviation from the average of each investment instruments. The higher standard deviation value means the higher risk of the investment. Here the formula to measure standard deviation (σ):

$$\sigma = \sqrt{\frac{1}{n-1}\sum_{s=1}^{n}\left[r(s)-r\right]^2} \tag{2}$$

where:

σ = standard deviation of investment.

n = number of observation.

r(s) = return of investment.

r = average of investment.

Table 1 shows the operational variables used in this study include investment instruments, namely bitcoin, exchange rates, gold and stock.

4. Research Results

Statistical descriptions include the average, minimum value, maximum value and standard deviation of each investment instrument, namely bitcoin, exchange rate returns, gold returns and stock returns during the study period 2011–2020. Bitcoin's return has the largest average of 18% compared with returns from other investment instruments. In addition, the standard deviation of bitcoin returns has

Instrument	N	Min	Max	Mean	Std. dev.
Bitcoin (μ1)	120	−0.3887	4.7088	0.1800	0.6108
Exchange Rate (μ2)	120	−0.0905	0.1367	0.0040	0.0258
Gold (μ3)	120	−0.1212	0.1363	0.0035	0.0472
Stock (μ4)	120	−0.1676	0.0944	0.0049	0.0415

Source: data processing, 2021.

Table 2.
Descriptive statistic.

Instrument	Stock	Exchange Rate	Gold	Bitcoin
Stock	1			
Exchange Rate	−0.602	1		
Gold	0.218	−0.258	1	
Bitcoin	0.042	0.023	−0.018	1

Source: data processing, 2021.

Table 3.
Correlation matrix.

the largest value of 61.08% compared to other investment instruments. The range of bitcoin returns between −38.87% till 470.88%. **Table 2** shows the descriptive statistics of the investment instruments studied.

The correlation matrix between investment instruments can be found in **Table 3**. The highest correlation is obtained from the return stock and return exchange rate (−0.602). The more the stock return increases, the lower the return exchange rate will be. In other words, the stronger the rupiah exchange rate, the more the composite stock price index will increase. The strengthening of the rupiah exchange rate had an impact on increasing domestic economic growth so that investors invested heavily in stocks. Therefore, stock returns also increase when there is an increase in the rupiah exchange rate. Meanwhile, bitcoin does not show a correlation with other investment instruments which is indicated by a correlation matrix value below 5%. This figure shows that the bitcoin returns are not affected by the others instruments investments returns namely exchange rate, gold and stock returns.

An overview of the return fluctuations obtained from each investment instrument of stock return, exchange rate return, gold return and bitcoin return can be seen in **Figures 2–5**. Each investment instrument shows different return fluctuations. The lowest standard deviation is the exchange rate 2.58%, while the highest standard deviation is Bitcoin 61.08%. In other words, investment in bitcoin have the highest risk compared to the alternative investment instruments. The others investment instruments have low risk between 2.6% till 4.7%. Investment in foreign exchange rate has the lowest risk compared to the others alternative investments. Investment on gold and stock have similar risks around 4.2% to 4.7%.

The range of the largest fluctuation was obtained from the return on bitcoin investment, especially in the period 2012 to 2014. In 2013, bitcoin returns reached the highest point where returns increased from 10–70%. However, the return drastically decreased to (−5%) entering 2014. It means the investment in bitcoin get the highest return and also the highest risk compared to the others instrument of investment.

Figure 2.
The return stock 2011–2020. Source: data processing, 2021.

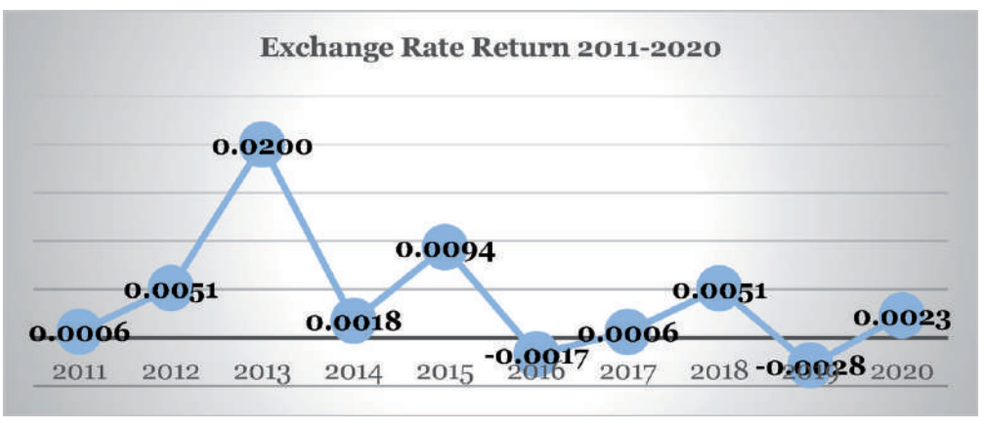

Figure 3.
The return exchange rate 2011–2020. Source: data processing, 2021.

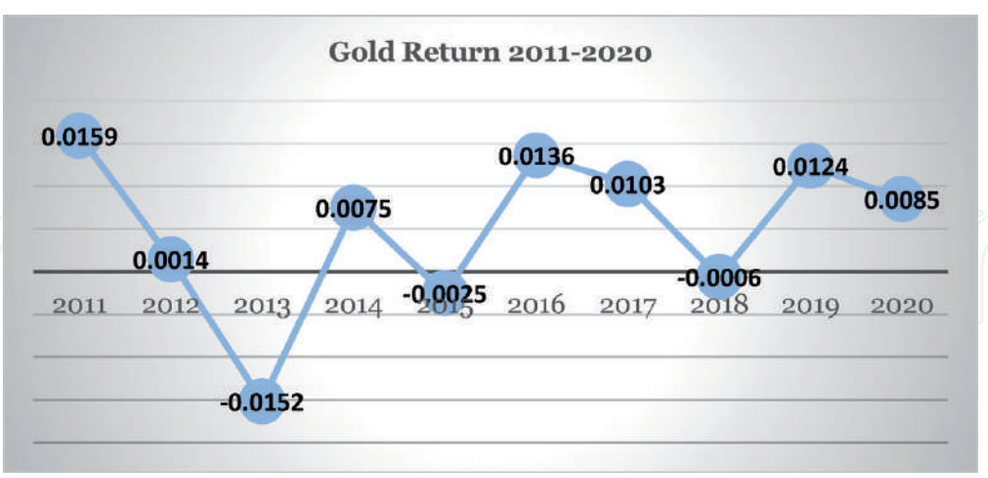

Figure 4.
The return gold 2011–2020. Source: data processing, 2021.

The next test was to compare the returns between each investment instrument through paired sample tests, namely stock-exchange rate, stock-gold, stock-bitcoin, exchange rate-gold, exchange rate-bitcoin and gold bitcoin. **Table 4** shows the results of the paired sample test of each investment instrument.

The results of the paired samples test of returns between investment instruments can be seen in **Table 4**. The results of the paired sample test between bitcoin and the others investment instruments shows significant level less than 0.01. It

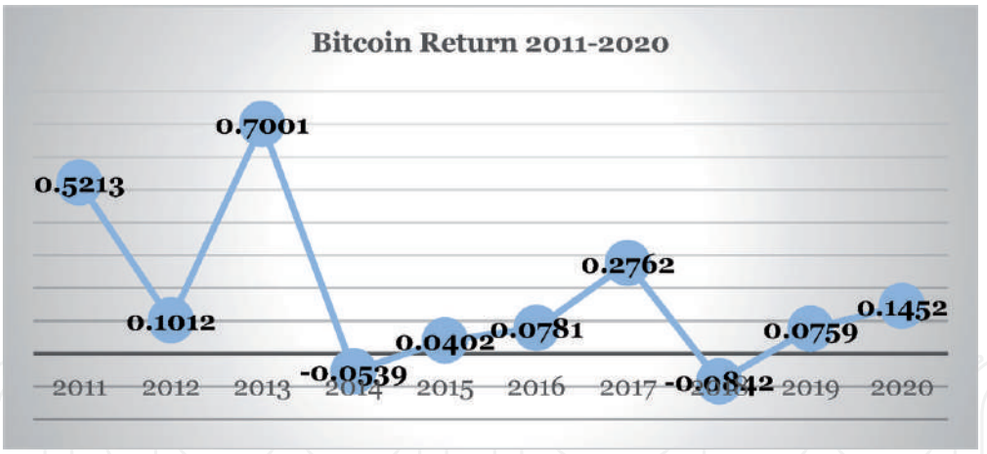

Figure 5.
Bitcoin return 2011–2020. Source: data processing, 2021.

Instrument	Mean	Std. dev.	Std. error mean	t	df	Sig.
Bitcoin - Ex. Rate	−0.1760	0.6108	0.0558	−3.156	119	0.002
Bitcoin - Gold	−0.1765	0.6135	0.0560	−3.151	119	0.002
Bitcoin - Stock	−0.1751	0.6105	0.0557	−3.143	119	0.002

Source: data processing, 2021.

Table 4.
Paired samples test.

means that is difference of return between bitcoin and the others investment instruments. The average means difference of bitcoin and the others investment instruments around −17.6%. Standard deviations show around 61% of investment on bitcoin. It means that the highest risk of bitcoin investments.

Based on the results of testing paired samples test return on investment between investment instruments and the explanation above, it can be concluded that the research hypothesis is as follows:

Ha1: There is a difference between the bitcoin and the exchange rate return (accepted at significance level 0.01).

Ha2: There is a difference between the bitcoin and the gold return (accepted at significance level 0.01).

Ha3: There is a difference between the bitcoin and the stock return (accepted at significance level 0.01).

One sample test is conducted to prove whether or not there are differences between the investment instruments used in this study. The one sample test results show that bitcoin returns provide a very significant difference ($\alpha < 0.01$) compared to other investment instruments: exchange rate, gold and stock. The average return of stock, exchange and gold investment instruments.

Table 5 shows analysis of variance single factor for each investment instruments. The variance of bitcoin the highest (0.37) if compared to stock, exchange rate and gold returns (0.001–0.002). It means there us a big different between bitcoin returns and the others investment instruments.

Table 6 shows analysis of variance to test hypothesis 4 whether there is significant level of the return. The result indicates that F calculation (0.9826) is higher than F critical value (2,624). It means there is significant different between bitcoin and the others investment instruments.

Groups	Count	Sum	Average	Variance
Stock return	120	0.585183	0.004877	0.001723
Ex-Rate return	120	0.483912	0.004033	0.000663
Gold Return	120	0.422361	0.00352	0.002228
Bitcoin return	120	21.60168	0.180014	0.373122

Source: data processing, 2021.

Table 5.
Anova single factor summary.

Source of variation	SS	df	MS	F	P-value	F crit
Between Groups	2.783868	3	0.927956	9.826513	0.00000	2.623637
Within Groups	44.95054	476	0.094434			
Total	47.73441	479				

Source: data processing, 2021.

Table 6.
Anova single factor test.

Based on the results of the analysis of variance single factor test shows that there is a difference between the average return of all investment instruments. Thus, the statistical hypothesis and research hypothesis (Ha4) is accepted at significant level 0.01 or can be written down as follows:

Ha4: There is a difference between the investment instruments (accepted at significance level 0.01).

Based on the average test between the research instruments used, bitcoin has a very significant difference in return compared to other investment instruments. Meanwhile, stock investment instruments, exchange rate and gold have the same average return.

5. Conclusions

Based on the research results discussed in the previous chapter indicate that the investment in bitcoin still promising. The price of bitcoin rapidly increase during the study 2011–2020. The rate of return of bitcoin investment is the highest compared to the other investment instruments: stock, exchange rate and gold. Meanwhile, the bitcoin investment also has the highest risk compared the others investment instruments.

It can be concluded that bitcoin investment provides the highest return (18%) compared to other investment instrument returns. However, the very high return on bitcoin comes with high risk investment. The risk of investing in bitcoin is indicated by a standard deviation of 61%, while the standard deviation of other instruments: stock, exchange rate and gold less than 5%.

Based on the results of the paired sample test, it shows that the average return on bitcoin shows a very significant difference compared to the others instrument. Meanwhile, the return on the others instrument: stock, exchange rate and gold show the same return.

For the investors who love risk, then the investment in bitcoin could be an alternative for an investment. The investment on bitcoin promise higher return compare

to the other investment instruments. For the investors who are risk aversion, an investment on bitcoin doesn't fit since this investment have the highest risk.

This research has practical implication for the investors who require high return. In the same time, the investors also have to understand the risk along the investment on bitcoin.

The other implication for government of Indonesia as policy maker on crypto currency. The crypto currency quite develops rapidly in this crypto world era. The role and regulation on crypto currency are needed to secure investors and economic growth.

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References

[1] Krafft, P. M., Della Penna, N., & Pentland, A. S. (2018, April). An experimental study of cryptocurrency market dynamics. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (pp. 1-13).

[2] Taskinsoy, J. (2019). Facebook's Libra: Why Does US Government Fear Price Stable Cryptocurrency? Available at SSRN *3482441*.

[3] Casino, F., Dasaklis, T. K., & Patsakis, C. (2019). A systematic literature review of blockchain-based applications: current status, classification and open issues. Telematics and informatics, *36*, 55-81.

[4] Macrinici, D., Cartofeanu, C., & Gao, S. (2018). Smart contract applications within blockchain technology: A systematic mapping study. Telematics and Informatics, *35*(8), 2337-2354.

[5] Underwood, S. (2016). Blockchain beyond bitcoin. Communications of the ACM, *59*(11), 15-17.

[6] Yli-Huumo, J., Ko, D., Choi, S., Park, S., & Smolander, K. (2016). Where is current research on blockchain technology? —a systematic review. PloS one, *11*(10), e0163477.

[7] Schinckus, C., Nguyen, C. P., & Ling, F. C. H. (2020). Crypto-currencies trading and energy consumption. International Journal of Energy Economics and Policy, *10*(3), 355.

[8] Bartolucci, S., & Kirilenko, A. (2020). A model of the optimal selection of crypto assets. Royal Society open science, *7*(8), 191863.

[9] Tarasova, T., Usatenko, O., Makurin, A., Ivanenko, V., & Cherchata, A. (2020). Accounting and features of mathematical modeling of the system to forecast cryptocurrency exchange rate. Accounting, *6*(3), 357-364.

[10] Mikhaylov, A. (2020). Cryptocurrency market development: Hurst method. Finance: Theory and Practice, *24*(3), 81-91.

[11] Voskobojnikov, A., Wiese, O., Mehrabi Koushki, M., Roth, V., & Beznosov, K. (2021, May). The U in Crypto Stands for Usable: An Empirical Study of User Experience with Mobile Cryptocurrency Wallets. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (pp. 1-14).

[12] Hachicha, A., & Hachicha, F. (2021). Analysis of the bitcoin stock market indexes using comparative study of two models SV with MCMC algorithm. Review of Quantitative Finance and Accounting, *56*(2), 647-673.

[13] Igoni, S., Onwumere, J. U. J., & Amaewhule, P. W. (2020). Digital currency and monetary policy in the South African economy: Praxis of financial dualism and suggestion for Nigerians. *Asian Journal of Economics, Finance and Management*, 49-57.

[14] Le Tran, V., & Leirvik, T. (2020). Efficiency in the markets of crypto-currencies. Finance Research Letters, *35*, 101382.

[15] Agosto, A., & Cafferata, A. (2020). Financial bubbles: a study of co-explosivity in the cryptocurrency market. Risks, *8*(2), 34.

[16] Rabbani, M. R., Khan, S., & Thalassinos, E. I. (2020). FinTech, blockchain and Islamic finance: An extensive literature review.

[17] Hairudin, A., Sifat, I. M., Mohamad, A., & Yusof, Y. (2020). Cryptocurrencies: A survey on

acceptance, governance and market dynamics. International Journal of Finance & Economics.

[18] Grobys, K., Ahmed, S., & Sapkota, N. (2020). Technical trading rules in the cryptocurrency market. Finance Research Letters, *32*, 101396.

[19] Amsyar, I., Christopher, E., Dithi, A., Khan, A. N., & Maulana, S. (2020). The Challenge of Cryptocurrency in the Era of the Digital Revolution: A Review of Systematic Literature. Aptisi Transactions on Technopreneurship (ATT), *2*(2), 153-159.

[20] Vaz de Melo Mendes, B., & Fluminense Carneiro, A. (2020). A Comprehensive Statistical Analysis of the Six Major Crypto-Currencies from August 2015 through June 2020. Journal of Risk and Financial Management, 13(9), 192.

[21] Tu, C., D'Odorico, P., & Suweis, S. (2020). Critical slowing down associated with critical transition and risk of collapse in crypto-currency. Royal Society open science, *7*(3), 191450.

[22] Fang, F., Ventre, C., Basios, M., Kong, H., Kanthan, L., Li, L.,... & Wu, F. (2020). Cryptocurrency trading: a comprehensive survey. *arXiv preprint arXiv:2003.11352*.

[23] Drożdż, S., Minati, L., Oświęcimka, P., Stanuszek, M., & Wątorek, M. (2019). Signatures of the crypto-currency market decoupling from the Forex. Future Internet, *11*(7), 154.

[24] Panagiotidis, T., Stengos, T., & Vravosinos, O. (2019). The effects of markets, uncertainty and search intensity on bitcoin returns. International Review of Financial Analysis, *63*, 220-242.

[25] Aysan, A. F., Demir, E., Gozgor, G., & Lau, C. K. M. (2019). Effects of the geopolitical risks on Bitcoin returns and volatility. Research in International Business and Finance, *47*, 511-518.

[26] Panagiotidis, T., Stengos, T., & Vravosinos, O. (2018). On the determinants of bitcoin returns: A LASSO approach. Finance Research Letters, *27*, 235-240.

[27] Koutmos, D. (2018). Bitcoin returns and transaction activity. Economics Letters, *167*, 81-85.

[28] Demir, E., Gozgor, G., Lau, C. K. M., & Vigne, S. A. (2018). Does economic policy uncertainty predict the Bitcoin returns? An empirical investigation. Finance Research Letters, *26*, 145-149.

[29] Balcilar, M., Bouri, E., Gupta, R., & Roubaud, D. (2017). Can volume predict Bitcoin returns and volatility? A quantiles-based approach. Economic Modelling, *64*, 74-81.

[30] Urquhart, A. (2016). The inefficiency of Bitcoin. Economics Letters, *148*, 80-82.

[31] Anonymous, investment.com, https://id.investing.com/crypto/bitcoin; access 8 April 2021

[32] Anonymous, harga emas, https://harga emas.org/history-harga/2021/April/07/, access 8 April 2021

[33] Anonymous, bank Indonesia, https:www.bi.go.id/id/statistic/informasi-kurs/transaksi-bi/Default.aspx, access 8 April 2021

Chapter

The Economic Effect of Bitcoin Halving Events on the U.S. Capital Market

Dina El Mahdy

Abstract

Bitcoin is a digital asset that was first mined in January 2009 after the global financial crisis of 2007–2008. Over a decade later, there is still no consensus across different market regulations on the classification, use cases, policies, and economic implications of bitcoin. However, there is an increasing demand for digital currency, as an alternative to fiat currency which would spur financial innovation and inclusion. This study reviews regulations on digital assets across countries. It further discusses some use cases for bitcoin to reduce financial risk and facilitate cross border transactions. The study also discusses challenges related to bitcoin such as: cryptocurrencies substitution, cross border financing, cyber risk and security, and benefits in terms of the effect of coronavirus on the speed of capital market innovation and hence bitcoin usage. The study concludes by examining the economic effect of bitcoin halving events on the U.S. capital market to better understand the influence of bitcoin on financial markets and key drivers of its intrinsic value. The empirical evidence from this study suggests that bitcoin halving events are associated with significant negative stock market reaction, signaling a trading tradeoff between cryptocurrencies and U.S. stock markets.

Keywords: Bitcoin, cryptocurrencies, halving event, crypto regulations

1. Introduction

Bitcoin emerged as an alternative source of fiat currency that is intended to be fast (i.e., electronic) and peer-to-peer that does not require the need of a third party (i.e., intermediaries like banks or governments). In his 2008 paper that marked the birth of bitcoin, Satoshi Nakamoto describes bitcoin as *"a system for electronic transactions without relying on trust"* [1]. Bitcoin is a *permissionless* system that is open to any user. To exchange bitcoin, blockchain technology, a distributed ledger technology (DLT), was developed as a medium of exchanging bitcoin. Blockchain technology, for example, is expected to transform many industrial sectors, reduce the processing costs, increase efficiency, eliminate intermediary costs, and decrease market frictions. Related, bitcoin, the leading cryptocurrency, has become widely traded as a borderless form of payment and is generally perceived as a store of value, such as gold. Unlike the fiat currency, bitcoin has been criticized for not being backed by trusted institutions, having high volatility, and a lack of correlations with other fiat currencies or stock indexes [2]. The present controversy over bitcoin challenges the notion that it is a "store of value".

Bitcoin can be visualized as a reward from solving a puzzle. Participants on the blockchain are usually connected to nodes/computers. To earn bitcoin, participants must solve a cryptographic problem using the "proof-of work" concept to reach consensus among nodes/computers and create a block. Once a block is created, bitcoin is generated as a reward. Every four years, the reward from mining bitcoin is reduced by half, a phenomenon called bitcoin halving. When bitcoin was first mined, the first chunk of mining reward was 50 bitcoin per block. Three halving events have happened since the inception of bitcoin, which were in 2012, 2016 and 2020. In 2012, the halving resulted in rewards from 50 to 25 bitcoin, and from 25 to 12.5 bitcoins after the 2016 halving event. The late halving event occurred on May 11, 2020, where the reward from bitcoin went down from 12.5 to 6.25 bitcoins per block. More interestingly, the trading price of bitcoin, which started around $0.0008 in July 2010, has reached over $40,000 in January 2021, raising the concerns and interests of various market constituencies including current and prospective traders, regulators, and policy makers (**Figure 1**).

In order to prevent inflation, there are only 21 million bitcoin that can be mined. As of February 2021, the total number of mined bitcoins is 18.5 million. To get to 18.5 million, it took roughly 10 years for miners. With 2.5 million remaining bitcoins to mine, it is uncertain whether the supply of bitcoin will stop at this point. Bitcoin is the first cryptocurrency, but it is not the last. Hundreds of cryptocurrencies are currently circulating in the market. In 2020, the market capitalization of cryptocurrencies went from $200 billion to $1 trillion. Bitcoin holders during COVID-19 witnessed the highest peak in prices since its inception. The rise in bitcoin prices during COVID-19 is claimed to be attributed to the slew of institutional investors who started to view bitcoin as the future of money. For example, MicroStrategy bought 70,000 bitcoins [3]. This unimaginable increase spurred speculation on whether this price surge is a bubble or simply a reaffirmation that it became more popular as a store of value. On December 17, 2017, bitcoin reached nearly $20,000 and a few days later, on December 22, 2017, the price dropped 45% to below $11,000.

The speculative nature of bitcoin has made it a lucrative investment opportunity for risk-takers as well as a threat to the stability of financial markets and innovation due to the high volatility of the ever-changing price. The controversy over the lack of intrinsic value of bitcoin, along with its ability to surpass gold, infused an uncertainty among market participants on whether it is a speculative short-term trading medium or an innovative new currency that is here for the long term. Therefore, regulators had to intervene to provide guidelines on the use, classification, and the trading of bitcoin. This chapter discusses bitcoin as an innovative venture tool of investment. More specifically, this chapter reviews global market

Figure 1.
Bitcoin historical prices (2010–2021).

regulations of bitcoin, classification, use cases, policies, and economic implications of trading bitcoin in the U.S. market. This chapter helps in understanding the nature of bitcoin, and its potential benefits as well as threats, not only to the U.S. market but also the global economy.

2. Market regulations for Bitcoin

2.1 Security versus currency

Is bitcoin a currency or investment instrument? The speculative nature of bitcoin, high volatility, low correlation with fiat currencies or gold, and vulnerability to cyber risk made regulators tend to classify it as an investment instrument rather than a currency. To be classified as a currency, bitcoin needs to have three functions: value storage, medium of exchange and account unit [2]. The International Securities Services Association (ISSA) classifies digital assets into four categories [4]: payment (i.e., cryptocurrencies), utility (i.e., provides digital access to an application), asset (i.e., security), and asset-backed (i.e., rights of ownership). Concerns about digital asset's nature, transparency, trading, and valuation have been the prime interests of policy makers and regulators. For example, trading on these assets requires an identification of whether these assets are considered as a "security" under federal jurisdiction. A security can be broadly defined as an investment contract or other instruments such as stocks and bonds. The U.S. Treasury has classified bitcoin as money services but not currency. That is, to subject bitcoin to market rules and regulations such as the Bank Secrecy Act and Anti Money Laundering Laws. For tax purposes, bitcoin is considered as a digital asset and thereby profits on trading bitcoins are taxable.

On April 3, 2019, the SEC released "Framework for 'Investment Contract' Analysis of Digital Assets" to determine whether a digital asset is a security under the Investment Company Act of 1940 and the Investment Advisers Act of 1940. The framework also made it possible to identify whether the security may no longer be a security. In the U.S., an investment contract exists if it meets the *Howey test*. According to the Howey test, an investment contract exist of there is an investment in an enterprise with attainable expectations of realized profits from the efforts of others [5]. This test extends to the facts and circumstances surrounding sale of digital assets (i.e., sale in the secondary market), if any. Sellers and offers of digital assets that qualify as security (i.e., investment contracts) must abide by the SEC's rules and regulations by either registering their securities or qualifying for an exemption, thereof. During the registration process, sellers would need to provide information about how managers plan to generate profit and exert efforts towards the successful continuation of the enterprise. This type of information provides *"full and fair disclosure"* to investors who seek investment contract and helps in reducing the asymmetric information among managers and prospective investors.

Elements of the *Howey test* include the following:

1. Investment of money through the sale of digital assets in exchange of value. This condition usually exists because there is always a sale of such assets as the first step of recognizing its existence.

2. Common enterprise must exist.

3. Reasonable expectation of profits derived from efforts of others. The efforts of others could be promoters, sponsors, or active participant. Under the Howey

test, price appreciation should not result solely from external market forces. Rather, reasonable expectation of profits comes from the capital appreciation that results from investment in the enterprise. Therefore, to meet the Howey test, the digital asset should give the investor the right to share profits (i.e., dividends) in the enterprise. The federal court examines other characteristics of digital assets such as the economic reality of transaction to identify whether there is reasonable expectation of profit derived from the efforts of others. Among these considerations are: (1) whether digital assets are fully developed, (2) whether holders of such assets can use it immediately, (3) whether the structure of digital assets meets the expectation of holders of such assets, and (4) whether it can be used as to make payments, in case of virtual currency.

A digital asset that meets the criteria of "security" is still a topic of interest by regulators because of the complex issues associated with after selling this security, such as valuation, classification in the balance sheet, and operational risk. For example, the below issues were raised by the SEC in a comment letter [6]:

1. Valuation: cryptocurrencies, for example, are highly volatile and new to the futures market. It is unclear how would managers assess the fair values of such assets.

2. Classification: how would digital assets be classified in financial statements (i.e., short vs. long term)?

3. Operational risk: how would manipulation in the digital asset prices in the financial market affect its trading?

The US federal securities laws and regulations also apply to Decentralized Autonomous Organization (DAO) that uses decentralized or distributed ledger such as blockchain technology. In July 2017, the SEC considered Slock.it UG digital asset as a "security", however, decided against pursuing enforcement action towards it. [7] Slock.it is a DAO, a virtual organization that is executed on a distributed ledger or blockchain. The virtual organization sold 1.15 billion DAO in exchange for 12 million ether (ETH) that was later valued at $150 million at the time of the sale. The SEC concluded that the co-founders of Slock.it promoted their DAO using various platforms, the company was audited by leading security audit companies, and solicited media interest. The DAO tokens that were issued in exchange for Ethereum (ETH), which gave holders certain voting and ownership rights and prospect of earning a return on investment. Therefore, the SEC deemed the DAO token as a security for the following reasons: (1) the SEC securities laws apply to virtual organization making use of distributed ledger technology, (2) investors in the DAO invested money, (3) there was a reasonable expectation of profits, (4) the assumed profits are derived from the managerial efforts of others because the efforts of the co-founders and the DAO's curators were essential to the enterprise.

Cryptocurrencies classification varies across countries. For example, in November 2019, digital assets were recognized as a property/commodity according to the UK Jurisdiction Taskforce [8]. More specifically, digital assets exhibit four characteristics: (1) definable, (2) identifiable by third parties, (3) capable in their nature of assumption by third parties, and (4) having some degree of permanence. The Financial Conduct Authority (FCA), the financial market regulatory authority in the UK, mandated that businesses dealing with digital assets to register with the authority by June 30, 2020, failing to register by the deadline would carry a penalty of case trading [9]. According to the FCA, digital assets can be classified as

regulated and unregulated tokens. Regulated tokens are security tokens and e-money tokens, and unregulated tokens are utility and exchange tokens. Rules of classifying tokens include prospectus and transparency requirements, manager's certification regime, and principles of business.

2.2 Bitcoin use cases

Because of Bitcoin's features (i.e., irrevocability, anonymity, and low transaction costs) along with the rise of decentralized finance (DeFi), bitcoin has become widely used as a fast payment tool in buying/selling, smart contracts, voting, collateral, donations, and a trading investment. For example, bitcoin can be used as a substitute to cash and as a peer-to-peer electronic cash system as initially envisioned by Satoshi Nakamoto. Bitcoin can be used in smart contracts, which are stored codes that can be automatically excused using bitcoin as the electronic cash. It can also be used as collateral on DeFi networks. Bitcoin is one of the best tools or solutions to cross-border transfer of money without the need of intermediaries and hence considerably reduces the transactions fees. It is widely known as a tool to facilitate internet of value.

2.3 Bitcoin policies and regulations

The global capital market regulators realized the need for fostering innovation in the capital market by embracing nascent technologies (i.e., blockchain) and flexible forms of ownership/payment (i.e., digital assets, cryptocurrencies). On the one hand, in line with expectations that global jurisdictions are embracing innovative technologies, regulators around the world (i.e., USA, Singapore, Thailand, Switzerland, and Hong Kong) are issuing guidelines and framework to facilitate exchange of digital assets [4].

On the other hand, the speculative nature of bitcoin and high volatility mandate regulatory government intervention and the subsequent issuance of guidance and rules on the classification and use of bitcoin. The intervention of government regulators is, however, sometimes perceived as a setback to the innovative nature of bitcoin and emergence as peer-to-peer tool that discards intermediaries. Hence, there are unintended consequences with government regulations. Market intervention in cryptocurrency trading, in general, may include communications from regulators and/or issuances of regulatory rules. For example, in September 2017, the Chinese government halted trading on cryptocurrencies and banned initial coin offerings (ICOs). In April 2017, Japan issued the Payment Services Act and the Financial Instruments and Exchange Act that was later revised in 2020 to tighten restrictions on cryptocurrency custodians, but meanwhile allowed the use of crypto as digital assets. Indeed, Japan was the lead country in Asia to allow cryptocurrency to be a safe haven asset. In August 2020, the UK approved its first digital stock exchange, Archax. David Lester, former chief strategy officer of the London Stock Exchange Group mentioned that: *"Blockchain and tokenization are innovations that can empower more frictionless and transparent markets which, combined with an FCA regulated exchange like Archax, can deliver what capital providers, business leaders and founders now really need"* [10].

In 2015, the U.S. classified bitcoin as a commodity. Realizing the need to adapt to flexibility in financial market innovations, the Securities and Exchange Commission (SEC) has been diligently working towards protecting investor's rights as well as fostering innovation in the financial market by allowing it to develop exponentially and at the same time expanding the SEC federal rules and regulations to include digital assets. Additionally, in the US market, the regulatory oversight over digital

assets have become more developed and geared towards simplifying the rules and regulations. For example, the SEC modernized the digital asset securities settlement and condensed its steps from four to three to reduce the operational risk for broker-dealer who operate alternative trading system (ATS) [11]. The four steps are: (1) the buyer and seller send orders to ATS, (2) the ATS matches the orders, (3) the ATS notifies the buyer and seller with the matching process, and (4) the transaction is bilaterally settled. The streamlined process involves only three steps: (1) the buyer and seller send orders to ATS and instruct their custodian to settle the transactions when the match is announced on the ATS, (2) the ATS matches the order, and (3) the ATS notified the buyer and seller with the matched and the custodians of the parties execute the instructions. However, digital assets regulations in the US market are not uniform across the states [12]. Some states (i.e., Wyoming, Colorado, Oklahoma) are "crypto-friendly" while others are not (i.e., Iowa). Crypto-friendly states promote bitcoin as a faster and more efficient payment system by reducing regulatory barriers and leveraging investment in the technology and allowing for a wider adoption among the community participants. For example, legislatures in Wyoming supported the initiation of a special purpose depository institutions to handle digital assets. Likewise, lawmakers in Colorado exempted cryptocurrencies from state securities regulations. While the SEC declared Bitcoin and Ethereum not to be securities, it used a double standard with XRP, the Ripple token, when it sued Ripple and two of its executive, claiming that Ripple sold unlicensed securities. Although Ripple has been in circulation since 2012, the SEC only initiated the lawsuit in late 2020, a few days before President Trump administration left SEC leadership, starting speculations about the interference of politics with cryptocurrency regulations. Ripple claims that the SEC suit caused XRP's price to plummet, accumulating in over $15 billion in losses. Notably, President Trump twitted in different occasions about cryptocurrency and bitcoin *"not a fan of highly volatile cryptocurrencies based on thin air that facilitate unlawful behavior,"* causing more volatility in the cryptocurrency market. The disagreement among regulators within the U.S. and outside it makes it more difficult to embrace blockchain technology and the power that digital assets (i.e., cryptocurrency) can bring to the market.

The study made by Park et al. [13] examine the exogenous shocks of local regulations on bitcoin prices and trading activities across six countries. Anecdotal evidence suggests that market regulations have a short-term impact on bitcoin price and a long-term suppressive trading effect. More interestingly, bitcoin prices vary across jurisdictions and although regulations have a short-term influence on bitcoin prices, the market for bitcoin is sought to be globally integrated and local frictions are weak to persist in the face of bitcoin's strong international network.

The size of the global cryptocurrency market is too big to regulate by one government. In fact, anecdotal evidence suggests that regulations on bitcoin create market frictions and long-term decline in trading activities. Bitcoin was invented to cross borders and barriers, facilitate fast payment, reduce market frictions and transactions costs. Global efforts are required to achieve the tangible benefits of bitcoin and lessen the unavoidable negative consequences that usually comes with innovative technologies in times of need such as the unprecedented COVID-19.

3. Challenges facing Bitcoin

3.1 Bitcoin substitution

When bitcoin was invented by Satoshi Nakamoto, he developed blockchain as the tool or medium to exchange bitcoin. You may think of bitcoin as the vehicle and

blockchain as the road. Hence, one can imagine the power and innovation that comes with the invention of the first vehicle on the road. Yet, the present status of the cryptocurrency industry is that there are thousands of vehicles "cryptocurrencies" invented after bitcoin, each with its own features that may be incremental or decremental to bitcoin in functions. Bitcoin represents roughly 69% of the total market capitalization of cryptocurrencies that reached a peak of over $1 trillion on January, 6 of 2021. For example, Ethereum (ETH) is an altcoin that is used in a smart contract on the Ethereum network. Another substitute to bitcoin is XPR, which is a Ripple token that is using network of nodes of participating banks and financial institutions. Litecoin is another cryptocurrency that is four times faster than bitcoin and offer four times the amount of bitcoin supply (i.e., the total supply of bitcoin is 21 million while Litecoin's supply is 84 million). While bitcoin will remain the first innovative cryptocurrency, it is difficult to speculate that it is the best one on the road.

3.2 Bitcoin cross border financing

As a peer-to-peer transaction, bitcoin defies the central government sole right to issue currencies and calls for a decentralized flow of currency. The market for bitcoin is concentrated in six major markets (the USA, Japan, China, Europe, UK, and South Korea) that roughly represent 99% of bitcoin trading activities with China taking over 88% of total bitcoin trading as of 2018 [13]. Therefore, it is likely that if there are cross border usage of bitcoin, it will happen mostly among these six countries. The lack of a centralized authority to regulate bitcoin along with its high tendency to be anonymous even though create an opportunity for faster and cheaper cross border transfer of currency, it opens another gate to illegal transfer of money. More specifically, one major risk associated with bitcoin is capital flight. The problem intensifies when bitcoin transaction is anonymized to cover cross-border money laundering. A study [14] examines bitcoin's capital flight from China to USA as the largest two originators of bitcoin transactions. It also examines whether market regulations can be effective in curbing the illegal transfer of bitcoin across countries. They use bitcoin-implied exchange rate discount as a proxy for bitcoin capital flight from China to the USA prior to China's announcement of regulations that banned financial institutions and payment companies from using bitcoin transactions. Further, they document that China's regulatory regime successfully halted this transaction. Therefore, the intervention of financial institutions in regulating bitcoin is becoming more crucial to reduce the likelihood of using it in illicit activities and improve transparency in trading.

3.3 Bitcoin cyber risk and security

Expectedly, bitcoin price variability across exchanges may involve illegal behavior and anomalies related to ask and bid prices [15]. The European Central Bank (ECB) Regulations on bitcoin are meant to curb illegal trading, reduce cyber-attacks, and protect investors. However, it is unclear whether individual bitcoin regulations across different jurisdictions can make a global impact on bitcoin trading activities. Additionally, bitcoin's virtual nature made it subject to lost and disappearance. For example, 20% of the 18.5 million circulated bitcoins are believed to be lost because owners of these bitcoins have lost their password to nearly $140 billion in bitcoins. In 2014, Mt. Gox trading platform in Tokyo went bankrupt [16] leaving 850,000 bitcoins owners clueless trying to find their passwords. James Howells from the UK mistakenly dumped his computer hard drive that includes 7,500 bitcoins that he mined in 2009. The fact that the identity of bitcoin developer

is anonymous also raises speculation on whether bitcoin was originally developed for the dark web. Bitcoin can be used for money laundry and can help perpetrators cover up their identities. Ransomware attacks in the digital age includes demands for bitcoin, which made bitcoin a tool used for cyber-attacks. It is estimated that bitcoin drives ransomware of $1.4 billion in the U.S. Cyber risk and security are one of the key barriers to bitcoin evolution as a mainstream digital currency.

3.4 Bitcoin other challenges

Another study [17] raised other concerns not addressed by the SEC in their framework such as whether digital assets traded by "Airdrop" are considered a security and the status of digital assets traded overseas. Lack of regulatory clarity of such important issues hampers the development of digital assets and blockchain technology. Challenges to securities service providers and their clients have been raised by [4] as obstacles towards getting the most out of tokenization. Some of these challenges include lack of common standards and interoperability after the introduction of new concepts by market participants. Issues regarding market stability from digital assets are also of great concerns to investors, regulators, activists, and various stakeholders. Barriers of entry (i.e., fiduciary obligation) of institutional investors into the digital asset world has slowed down the development of digital assets and underlying blockchain technology, at least this was the case before the onset of COVID-19. Among other impediment to the development of digital asset worldwide are various regulations across regulations, fraud, lack of scaling by blockchain technology and balancing scalability and security. Park, Sang, Lee, and Jang (2019) raised two critical issues related to digital assets: privacy and access by third party after death. Related, another study [18] questioned whether people should be able to inherit digital assets and whether to consider social media accounts (i.e., Email accounts, Facebook, Twitter, LinkedIn) as digital assets because they contain monetary value and are real.

4. The economic effect of Bitcoin halving events on capital markets

An interesting question on whether bitcoin came up with net economic benefits to the U.S. financial system is still unanswered. Anecdotal evidence suggests that bitcoin prices are influenced by the quality of financial system (governance and regulations) it exists at. Nevertheless, the major characteristics of bitcoin are its volatility and price unpredictability, two major factors that are more than enough to hinder its international recognition as an innovative payment system that has the potential of replacing fiat currencies. These features are, however, puzzling. Why would bitcoin prices decline by 50% on March 12, 2020 and go up by 36% on November 19, 2013, while the global stock indexes do not synchronize in movement in the same manner? Additionally, anecdotal evidence suggests that bitcoin prices vary across different markets due to differences in market infrastructure, financial frictions, regulatory oversight, and institutional investors [12, 19].

Although the market for bitcoin is dispersed worldwide, it is globally integrated by a diverse group of bitcoin holders. When the total market capitalization reached out a peak of $1 trillion on January 6, 2021, market participants started to contemplate on whether this unimaginable magnitude of the cryptocurrency market that is mainly sparked by bitcoin is frothy. In this section, I empirically test the economic consequences of bitcoin halving events on the U.S. capital market. More specifically, I examine the market reaction to bitcoin's first and second halving events that occurred over the past decade. There are three halving events occurred since 2009. The first

Pearson correlation coefficients											
	1st_E	**2nd_E**	**Δ BTC**	**Δ BCH**	**Δ ADA**	**Δ LINK**	**Δ ETH**	**Δ LTC**	**Δ XLM**	**Δ USDT**	**Δ XRP**
CAR	0.001[a]	0.002[a]	−0.002[a]	0.001[a]	0.004[a]	0.00[a]	0.003[a]	0.00	0.002[a]	−0.002[a]	−0.002[a]
1st_E		−0.00[c]	−0.00	−0.00	0.00	−0.00	−0.00	−0.00	−0.00	−0.00[a]	0.00
2nd_E			0.002[a]	−0.00	0.00	−0.00	−0.00	−0.00	−0.00	0.00[a]	0.001[a]
Δ BTC				0.254[a]	0.264[a]	0.200[a]	0.545[a]	0.45 1[a]	0.309[a]	0.068[a]	0.620[a]
Δ BCH					0.206[a]	0.058[a]	0.450[a]	0.241[a]	0.253[a]	0.113[a]	0.022[a]
Δ ADA						0.050[a]	0.467[a]	0.211[a]	0.772[a]	0.025[a]	0.042[a]
Δ LINK							0.097[a]	0.124[a]	0.066[a]	0.018[a]	−0.016[a]
Δ ETH								0.564[a]	0.462[a]	0.082[a]	0.183[a]
Δ LTC									0.237[a]	0.079[a]	0.236[a]
Δ XLM										0.068[a]	0.059[a]
Δ USDT											−0.026[a]

1st_E is an indicator variable for the first halving event that occurred on November 28, 2012, zero otherwise. 2nd_E is an indicator variable for the second halving event that occurred on July 9, 2016, zero otherwise. Δ BTC is the change in returns on bitcoin as measured by the difference in bitcoin prices in day t and day t-1. Δ BCH is the change in returns on bitcoin cash as measured by the difference in bitcoin cash prices in day t and day t-1. Δ ADA is the change in returns on Cardano coin as measured by the difference in Cardano prices in day t and day t-1. Δ LINK is the change in returns on ChainLink coin as measured by the difference in ChainLink prices in day t and day t-1. Δ ETH is the the change in returns on Ethereum coin as measured by the difference in Ethereum prices in day t and day t-1. Δ LTC is the change in returns on Litecoin as measured by the difference in Litecoin prices in day t and day t-1. Δ XLM is the change in returns on Stellar Lumens as measured by the difference in Stellar Lumens prices in day t and day t-1. Δ USDT is the change in returns on Tether coin as measured by the difference in Tether prices in day t and day t-1. Δ XRP is t the change in returns on Ripple token (XRP) as measured by the difference in XRP prices in day t and day t-1.

[a]*Significance levels at 1%.*

[b]*Significance levels at 5%.*

[c]*Significance levels at 10%.*

Table 1.

Summarizes the Pearson correlations among cryptocurrencies, returns and halving events.

halving occurred on November 28, 2012 and ended up with reducing the rewards from mining for bitcoin from 50 to 25 bitcoins per block. The second halving further reduced the reward to 12.5 bitcoins per block when it occurred on July 9, 2016. The last halving at the time of writing this study occurred on May 11, 2020 and reduced the rewards from bitcoin mining to 6.25 bitcoins per block. Due to lack of data on CRSP database post 2019 about stock prices, this study focuses on examining the stock market reactions to the first and second halving events that occurred in 2012 and 2016.

The halving event is intended to reduce bitcoin's inflation rate. It is usually scheduled when miners solve a certain number of blocks and happens every 210,000 blocks. The next halving will happen when miners reach out 840,000 blocks and it is scheduled to happened between February 2024 and June 2024. Litecoin rewards is also halved every four years but it does not sync with bitcoin halving events.

I started my sample by July 18, 2010 and ended on December 31, 2019 as CRSP database does not provide stock returns date for the year 2020 yet. This restriction in the available dataset will not allow the empirical testing of the third halving event as previously stated that occurred on May 11, 2020. To examine the economic effect of bitcoin halving events on the U.S. capital market, I first estimate stock returns using the Capital Asset Pricing Model (CAPM) and then calculate abnormal returns as the difference between actual and estimated returns. Then, I cumulate abnormal returns to calculate Cumulative Abnormal returns (CARs) around difference length of return windows, a short window (2 days) and long window (10 days).

I first ran a Pearson correlation among cryptocurrencies, halving events, and stock returns. The results of the correlation analysis are displayed in **Table 1** that shows positive and significant correlations at 1% between the two halving events (1st_E and 2^{nd}_E) under investigation and contemporaneous stock returns (R). The magnitude of the correlation is very weak. There is a negative significant correlation at 1% between contemporaneous stock returns (R) and change in bitcoin (ΔBTC), suggesting that an increase in BTC corresponds to a decrease in R. However, other altcoins, cryptocurrencies other than bitcoin, such as ADA, LINK, ETH, and XLM seem to be positively correlated with R.

The result of the event study on the effect of bitcoin halving events on the U.S. capital market is summarized in **Tables 2** and **3** and **Figures 2–5**. **Table 2** summarizes the results of CARs and lists its correspondence t-test with the level of significance for the test of the first halving event. As shown in Panel A, CARs around 2 days return window of the first bitcoin halving shows that the first bitcoin halving event has a significant negative market reaction on the event date. CARs shows a decline two days before the event date and then an increase starting from day +1. Panel B shows the results using 10 days return window and the results show large fluctuations around the halving event. The use of a large return window should be interpreted with caution since other market events may confound the results. **Figures 2** and **3** confirms the results displayed in **Table 2** by showing the negative market reaction on day zero (the event date). **Table 3** summarizes the results of CARs and lists its correspondence t-test with the level of significance for the test of the second halving event. Because the second halving event occurred during a holiday, I used July 11, 2016 as the event date when the market opened to capture the market reaction after the second halving event. Although the results in Panel (A) of **Table 3** show significant positive CARs on the event date, the CARs are significantly declining from day −1 to day 0 (the event day, suggesting that the second halving event still causes a downward abnormal stock returns but perhaps not with the same negative magnitude caused by the first halving event. Panel (B) of **Table 3** displays CARs around 10 days return window and as expected CARs fluctuates around the event and showing the lowest significant statistical decline on

CAR_{it} around the 1st Bitcoin Halving Event on Nov. 28, 2012					
Panel A: CAR_{it} around 2 days return-window					
Days	−2	−1	0	1	2
CAR_{it}	0.0041	0.0014	−0.0015	0.0022	0.0029
t-test	(7.44)***	(3.02)***	(−4.91)***	(5.05)***	(5.59)***
No. Obs.	6654	6655	6656	6653	6652
Panel B: CAR_{it} around 10 days return-window					
Days	−10	−5	0	5	10
CAR_{it}	−0.0034	0.0051	−0.0015	0.0030	0.0029
t-test	(−3.36)***	(7.16)***	(−4.91)***	(4.20)***	(2.63)***
No. Obs.	6644	6652	6656	6640	6631

**Significance levels at 10%*
***Significance levels at 5%*
**** Significance levels at 1%*

Table 2.
Displays the Cumulative Abnormal Stock Returns (CAR) around two event windows, 2 days as in Panel (A) and 10 days as in Panel (B) for the 1st bitcoin halving event.

CAR_{it} around the 2nd Bitcoin Halving Event on July 9, 2016					
Panel A: CAR_{it} around 2 days return-window					
Days	−2	−1	0	1	2
CAR_{it}	0.0080	0.0063	0.0031	0.0068	0.0046
t-test	(7.44)***	(3.02)***	(9.93)***	(5.05)***	(5.59)***
No. Obs.	7178	7173	7170	7204	7201
Panel B: CAR_{it} around 10 days return-window					
Days	−10	−5	0	5	10
CAR_{it}	0.0043	0.0084	0.0031	0.0050	0.0056
t-test	(−3.36)***	(7.16)***	(9.93)***	(4.20)***	(2.63)***
No. Obs.	7207	7186	7170	7188	7176

**Significance levels at 10%*
***Significance levels at 5%*
**** Significance levels at 1%*

Table 3.
Displays the Cumulative Abnormal Stock Returns (CAR) around two event windows, 2 days as in Panel (A) and 10 days as in Panel (B) for the 2nd bitcoin halving event.

the event date. **Figure 4** and **5** shows the market reaction around the second halving event and supports the main conclusion reached from **Table 3**.

I also ran an OLS regression by regressing stock returns (R) on the halving events, change in bitcoin, change in altcoin, and industry categorization to get a better understanding on the nature of the economic effect of the halving events on stock returns. The results are displayed in **Tables 4** and **5**. **Table 4** summarizes the OLS regression on the association between contemporaneous stock returns as the dependent variable in all models and 1st bitcoin halving event halving, changes in bitcoin, changes in cryptocurrencies, and industry categorization as the independent variables. The 1st bitcoin halving event (1st_E) is the independent variable of interest. The coefficient on this variable (1st_E) is expected to be negative and

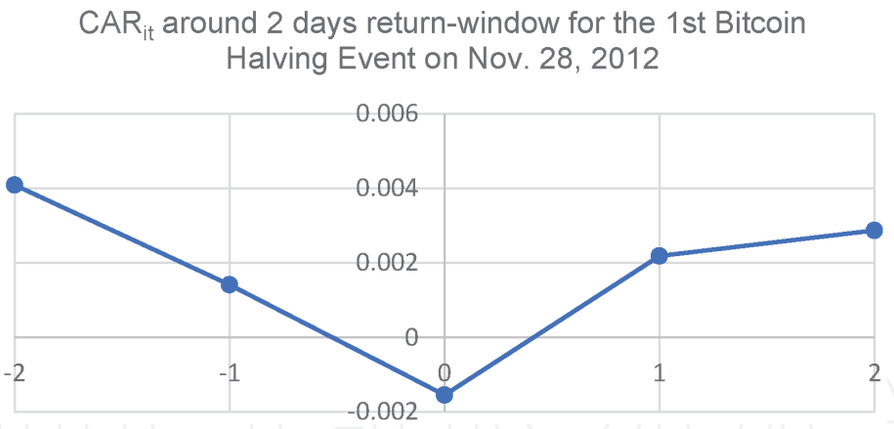

Figure 2.
CAR around 2 days return-window of the 1st Bitcoin Halving Event on November 28, 2012.

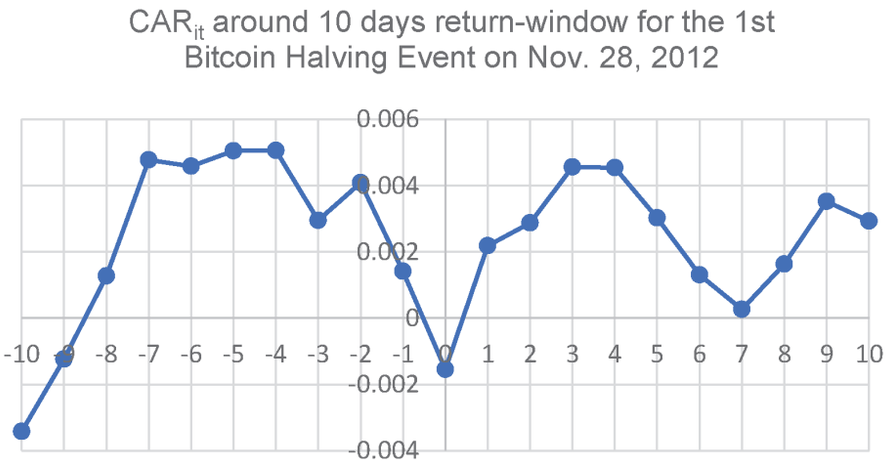

Figure 3.
CAR around 10 days return-window of the 1st Bitcoin Halving Event on November 28, 2012.

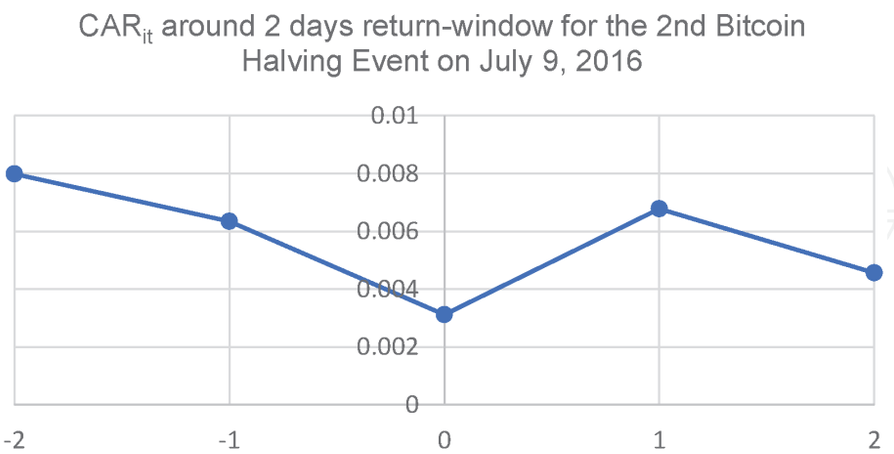

Figure 4.
CAR around 2 days return-window of the 2nd Bitcoin Halving Event on July 9, 2016.

significant, consistent with the documented results from the event study. As shown in **Table 4**, there is a significant negative association (coefficient = −0.00152) at 1% significance level between the first bitcoin halving event (1st_E) and stock returns (R). I used different variations of the regression model by regressing the contemporaneous stock returns on bitcoin, returns on other altcoins, industry categorization, and substituting cryptocurrencies returns with trading volumes as displayed in

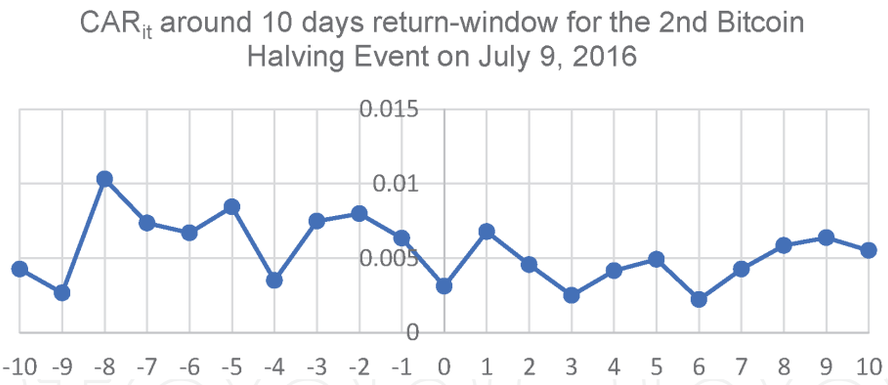

Figure 5.
CAR around 10 days return-window of the 2nd Bitcoin Halving Event on July 9, 2016.

models 1–7 and the results are still the same. **Table 5** summarizes the OLS regression on the association between contemporaneous stock returns (R) as the dependent variable and 2nd bitcoin halving event, changes in bitcoin, changes in cryptocurrencies, and industry categorization as the independent variables. The 2nd bitcoin halving event (2nd _E) is the independent variable of interest. The coefficient on this variable (2nd _E) is expected to be negative and significant, consistent with the documented results from the event study. The results in **Table 5** suggests the same conclusion from **Table 4** that the second halving event is statistically and significantly associated with negative stock returns. I used different variations of the regression model by regressing the contemporaneous stock returns on bitcoin, returns on other altcoins, industry categorization, and substituting cryptocurrencies returns with trading volumes as displayed in models 1–7 and the results are still the same. The results in this section suggests that bitcoin halving events, which eventually increased the demand on and price of bitcoin, are detrimental to the U.S. capital market because these events are associated with a downward abnormal stock returns around the announcement date.

5. Conclusions

It is indisputable that regulatory bodies across different countries lack harmony and agreement on bitcoin classification, use cases and policies. Even within the same country such as the case in the U.S., bitcoin regulations diverge widely across different states. And despite regulatory intervention, or lack thereof, across different jurisdictions, bitcoin stood against regulatory constraints in terms of financial performance in the cryptocurrency world. It showed steady increase over the past decade and most notably over the past several months, especially during COVID-19 era that hastened decades of innovation. However, it is unclear whether COVID-19 accelerated the need for financial innovation and hence contributed to a surge in bitcoin price or the market is presently experiencing a bubble. The conclusion from this study is that bitcoin scarce supply as measured by the decline in the reward from bitcoin is detrimental to the U.S. capital market because the halving events are significantly associated with negative abnormal stock returns around the announcement days. The results suggest that the second halving event has less of an impact on the stock market than the first halving event. Future research may study the market reaction to the third halving event and examine whether the results will remain the same.

The theoretical argument and conclusion from this study are of benefits to many market constituencies such as regulators, practitioners, research scholars, and

	Model (1)	Model (2)	Model (3)	Model (4)		Model (5)	Model (6)	Model (7)
				Dependent variable = R				
Intercept	−0.00002***	−0.00002***	−0.00002***	−0.00001	**Intercept**	−0.00002**	−0.00002***	−0.00002***
1st_E	−0.00152***	−0.00152***	−0.00153***	−0.00153***	**1st_E**	−0.00152***	−0.00152***	−0.00152***
Δ BTC		0.00000***	0.00000***	0.00000***	**Δ BTC_V**	0.00000***	0.00000***	0.00000***
Δ BCH			0.00000	0.00000	**Δ BCH_V**		0.00000***	0.00000***
Δ ADA			0.01236***	0.01236***	**Δ ADA_V**		0.00000***	0.00000***
Δ LINK			0.00081***	0.00081***	**Δ LINK_V**		0.00000***	0.00000***
Δ ETH			0.00001***	0.00001***	**Δ ETH_V**		0.00000	0.00000***
Δ LTC			0.00000**	0.00000**	**Δ LTC_V**		0.00000***	0.00000***
Δ XLM			−0.00336***	−0.00336***	**Δ XLM_V**		0.00000***	0.00000***
Δ USDT			−0.01586***	−0.01587***	**Δ USDT_V**		0.00000***	0.00000***
Δ XRP			0.00000	0.00000	**Δ XRP_V**		0.00000***	0.00000***
INDUSTRY	No	No	No	Yes	**INDUSTRY**	No	No	Yes
F-Ratio	15.69	28	57.89	29.12	F-Ratio	50.14	46.02	23.18
P-Value	<.0001	<.0001	<.0001	<.0001	P-Value	<.0001	<.0001	<.0001
# Obs.	16,621,212	16,621,212	16,621,212	16,621,212	# Obs.	16,621,212	16,621,212	16,621,212

1st_E is an indicator variable for the first halving event that occurred on November 28, 2012, zero otherwise. Δ BTC is the change in returns on bitcoin as measured by the difference in bitcoin prices in day t and day t-1. Δ BCH is the change in returns on bitcoin cash as measured by the difference in bitcoin cash prices in day t and day t-1. Δ ADA is the change in returns on Cardano coin as measured by the difference in Cardano prices in day t and day t-1. Δ LINK is the change in returns on ChainLink coin as measured by the difference in ChainLink prices in day t and day t-1. Δ ETH is the change in returns on Ethereum coin as measured by the difference in Ethereum prices in day t and day t-1. Δ LTC is the change in returns on Litecoin as measured by the difference in Litecoin prices in day t and day t-1. Δ XLM is the change in returns on Stellar Lumens as measured by the difference in Stellar Lumens prices in day t and day t-1. Δ USDT is the change in returns on Tether coin as measured by the difference in Tether prices in day t and day t-1. Δ XRP is t the change in returns on Ripple token (XRP) as measured by the difference in XRP prices in day t and day t-1.

**Significance levels at 10%.*

***Significance levels at 5%.*

****Significance levels at 1%.*

Table 4.

Summarizes the OLS regression on the association between stock returns and 1st bitcoin event halving and changes in crypto currencies.

	Model (1)	Model (2)	Model (3)	Model (4)		Model (5)	Model (6)	Model (7)
	Dependent variable = R							
Intercept	−0.00002***	−0.00002***	−0.00002***	−0.00001	**Intercept**	−0.00002**	−0.00002***	−0.00002***
2nd_E	−0.00314***	−0.00315***	−0.00316***	−0.00316***	**2nd_E**	0.00313***	0.00314***	0.00314***
Δ BTC		0.00000***	0.00000***	0.00000***	**Δ BTC_V**	0.00000***	0.00000***	0.00000***
Δ BCH			0.00000	0.00000	**Δ BCH_V**		0.00000v**	0.00000***
Δ ADA			0.01236***	0.01236***	**Δ ADA_V**		0.00000***	0.00000***
Δ LINK			0.00081***	0.00081***	**Δ LINK_V**		0.00000**	0.00000***
Δ ETH			0.00001***	0.00001***	**Δ ETH_V**		0.00000	0.00000
Δ LTC			0.00000**	0.00000**	**Δ LTC_V**		0.00000***	0.00000***
Δ XLM			−0.00336****	−0.00336***	**Δ XLM_V**		0.00000***	0.00000***
Δ USDT			−0.01586***	−0.01587***	**Δ USDT_V**		0.00000***	0.00000***
Δ XRP			0.00000	0.00000	**Δ XRP_V**		0.00000***	0.00000***
INDUSTRY	No	No	No	Yes	**INDUSTRY**	No	No	Yes
F-Ratio	72.23	56.39	63.60	31.98	F-Ratio	78.06	51.67	26.00
P-Value	<.0001	<.0001	<.0001	<.0001	P-Value	<.0001	<.0001	<.0001
# Obs.	16,621,212	16,621,212	16,621,212	16,621,212	# Obs.	16,621,212	16,621,212	16,621,212

2nd_E is an indicator variable for the second halving event that occurred on July 9, 2016, zero otherwise. Δ BTC is the change in returns on bitcoin as measured by the difference in bitcoin prices in day t and day t-1. Δ BCH is the change in returns on bitcoin cash as measured by the difference in bitcoin cash prices in day t and day t-1. Δ ADA is the change in returns on Cardano coin as measured by the difference in Cardano prices in day t and day t-1. Δ LINK is the change in returns on ChainLink coin as measured by the difference in ChainLink prices in day t and day t-1. Δ ETH is the the change in returns on Ethereum coin as measured by the difference in Ethereum prices in day t and day t-1. Δ LTC is the change in returns on Litecoin as measured by the difference in Litecoin prices in day t and day t-1. Δ XLM is the change in returns on Stellar Lumens as measured by the difference in Stellar Lumens prices in day t and day t-1. Δ USDT is the change in returns on Tether coin as measured by the difference in Tether prices in day t and day t-1. Δ XRP is t the change in returns on Ripple token (XRP) as measured by the difference in XRP prices in day t and day t-1. ΔBTC_V is the change in trading volume of BTC, ΔBCH_V is the change in trading volume of BCH, ΔADA_V is change in the trading volume of ADA, ΔLINK_V is the change in trading volume of LINK, ΔETH_V is the change in trading volume of ETH, ΔLTC_V is the change in trading volume of LTC, ΔXLM_V is the change in trading volume of XLM, ΔUSDT_V is the change in trading volume of USDT, ΔXPR_V is change in the trading volume of XRP.

**Significance levels at 10%.*

***Significance levels at 5%.*

****Significance levels at 1%.*

Table 5.

Summarizes the OLS regression on the association between stock returns and 2nd bitcoin event halving and changes in crypto currencies.

cryptocurrency traders. For example, current and prospective cryptocurrency traders should bear in mind that the price surge in cryptocurrencies that is mainly driven by the past, most recent bitcoin halving event in 2020, and the current pandemic is negatively associated with their investment in the U.S. capital market. Therefore, perhaps having a diverse portfolio to hedge the risk associated with investing solely in one market is a good investment strategy at the present time. Additionally, evidence suggests that the cryptocurrency market is highly volatile, if new traders would like to penetrate this unique market, they should wait until the price drops to a reasonable level they can afford and they should not put all their savings (i.e., pension funds, college savings) into this market. Likewise, it is always a good strategy to exit the cryptocurrency market "temporarily" when traders achieve certain level of profits (i.e., 30%) and then reinvest again when the market experience sudden decline and it will eventually happen because sharp volatility is a primary trait of cryptocurrency market. Regulators should be aware that the gigantic size of bitcoin and other cryptocurrencies is not going to vanish, and it would be beneficial for regulators to work with those in other jurisdictions on a local, national, and international levels to regulate this market. Regulating cryptocurrency market will come up with several tangible advantages. First, it will reduce the risk associated with cryptocurrencies' cyber-attacks. Second, it will stabilize the price of cryptocurrencies so that the market gets the anticipated benefits of using cryptocurrencies in blockchain applications. Scholars who would like to examine the risks and benefits of cryptocurrencies may attempt to investigate the economic consequences of corporate investment in cryptocurrencies on financial performance or financial reporting quality such as accounting conservatism and internal control quality. For example, a firm may use investment in cryptocurrencies to cover up its poor financial performance and signal a better performance. In early 2021, Tesla company invested $1.5 billion in bitcoin where the price was (and still) skyrocketing. Speculators believe that Tesla made between $0.29 to $0.98 billion profit just from investment in bitcoin during a very short period. Notably, Telsa's profit in 2020 per form 10-K was a modest $721 million. This previous example illustrates how some companies can make "everything" from trading in cryptocurrencies. Nevertheless, it does not rule out the possibility that everything can turn into "nothing" if the price of bitcoin tailspins to the opposite direction with the news of reopening the global market and getting vaccinated against the risk of exposure to coronavirus.

It is worthwhile to note that despite the increase in bitcoin in 2020, investors still consider it a venture tool of investment. Proponents of bitcoin argue that it shares characteristics with gold (i.e., scarce, mined, international) and can be used for hedging and diversifying asset. However, gold is "scientifically" not scarce as evidence [20] suggests that gold can be formulated instantaneously within a few tenths of a second in response to earthquakes. With the same token, it is reasonable to assume that bitcoin miners may be able to change its protocol and increase its supply. With too much uncertainty at stake, it is difficult to make a prediction that bitcoin is the future of money. Nevertheless, there is quite agreement that blockchain technology is valuable tool for many applications (i.e., supply chain management) and in order for blockchain to function, an efficient form of cryptocurrency (virtual money) is needed.

The question whether bitcoin will reach $500,000 per coin or dive into $1,000 a decade from today is not the correct answer at the present time. A relevant question would be whether bitcoin can improve our lives, decrease transaction cost, accelerate transfer of money, reduce market frictions, reduce cyber-attacks and fraudulent activities, and eliminate intermediaries' costs. Another interesting question is perhaps whether bitcoin is a safe haven against financial crises? The limited supply of

the total amount of bitcoin that can be circulated along with the mining reward that is split into half every four years made it, by definition, a scarce commodity. Using a simple equilibrium scenario, plotting the demand and supply of bitcoin shows that the price is poised to rise in the future, but this is under the assumption that bitcoin is the only cryptocurrency in the market, which is untrue. Related, it is not impossible to change the bitcoin protocol and increase the amount of its supply. Therefore, the economic as well as real benefits of bitcoin to the market still open for discussion and future research is needed to provoke in depth discussion about its assumed risk and benefits to market constituencies.

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References

[1] Nakamoto S. Bitcoin P2P e-cash paper. 2008. Working paper available at: https://bitcoin.org/bitcoin.pdf

[2] Yermak D. Is bitcoin a real currency? An economic appraisal. 2013; NBER working paper 19747. DOI 10.3386/w19747

[3] Voel Z. Total Cryptocurrency Market Value Hits Record $1 Trillion. 2021. Available at: https://www.coindesk.com/cryptocurrency-market-value-record-1-trillion

[4] Harwood-Jones M. Digital and crypto-assets: Tracking global adoption rates and impacts on securities services. Journal of Securities Operations and Custody. 2019; 12: (1) 49–58.

[5] SEC. Framework for "Investment Contract" Analysis of Digital Assets. Available at: https://www.sec.gov/files/dlt-framework.pdf

[6] SEC. Staff Letter: Engaging on Fund Innovation and Cryptocurrency-related Holdings. 2018. Available at: https://www.sec.gov/divisions/investment/noaction/2018/cryptocurrency-011818.htm

[7] SEC. Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO. 2017. Available at: https://www.sec.gov/litigation/investreport/34-81207.pdf

[8] Alderman P. UK High Court recognizes digital assets as property at common law. 2020. Available at: https://www.lexology.com/library/detail.aspx?g=83ae727b-2ff8-445a-aba0-b18a124e5b0a

[9] Murray D., and Petrie N. A Mix of Clarity and Confusion: Crypto Asset Law and Regulation in the UK. 2021; The National Law Review XI, 35. Available at: https://www.natlawreview.com/article/mix-clarity-and-confusion-crypto-asset-law-and-regulation-uk

[10] Delaney R. Archax authorised as first UK digital securities exchange. 2020. Available at: http://www.assetservicingtimes.com/assetservicesnews/article.php?article_id=10875

[11] David E. US SEC issues no-action letter on compressed digital asset settlement process 2020. Available at: https://cointelegraph.com/news/us-sec-issues-no-action-letter-on-compressed-digital-asset-settlement-process/amp

[12] Global Legal Insights. Blockchain and cryptocurrency regulation 2021. 2021. Available at: https://www.globallegalinsights.com/practice-areas/blockchain-laws-and-regulations/usa

[13] Park C, Tian S., and Zhao B. Global bitcoin markets and local regulations. ADB Economics Working Paper Series No. 605. 2020.

[14] Ju L., Lu T, and Tu Z. Capital flight and bitcoin regulation. International Review of Finance. 2015; 16(3): 445–455. https://doi.org/10.1111/irfi.12072

[15] Shi F-B, Sun X-Q, Gao J-H, Xu L, Shen H-W, and Cheng X-Q. Anomaly Detection in Bitcoin Market via Price Return Analysis, PLoS ONE, 2019; 14 (6): 1–11.

[16] Sullivan P. As Bitcoin's Price Surges, Affluent Investors Start to Take a Look. 2021. Available at: https://www.nytimes.com/2021/01/29/your-money/bitcoin-wealth-investors.html

[17] Berman K, Hayes M, Kaplan M, Lim B, Murphy G, Do Y, and Steinberg J. SEC framework and no-action letter provide guidance on analyzing whether a digital asset is a security. Journal of Investment Compliance. 2019; 20 (4): 68–71

[18] Toygar A, Rohm C, and Zhu J. A New Asset Type: Digital Assets. Journal of International Technology and Information Management. 2013; 22: (4) 113–120.

[19] Viglione R. Does Governance Have a Role in Pricing? Cross-Country Evidence from Bitcoin Markets. 2015; http://dx.doi.org/10.2139/ssrn.2666243. Available at SSRN: https://ssrn.com/abstract=2666243

[20] Weatherley, D. and Henley R. Flash vaporization during earthquakes evidenced by gold deposits. Nature Geoscience 2013; 6: 294–298. https://doi.org/10.1038/ngeo1759

Chapter

What Was Published in Accounting Education Journals about Accounting Teaching?

Rui Jorge Rodrigues da Silva,
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Abstract

The curricular units related to the accounting area are essential for any student in business sciences. However, it appears that students generally experience great learning difficulties when faced with its study. Bearing in mind the stated problem and its consequent importance, both in academic terms and for society in general, this article aims to: (1) Identify how many studies related to Accounting Education in Higher Education Institutions have been published in Accounting Education journals since started its scientific activity; (2) List a ranking of articles having as a criterion the number of citations; (3) Describe the main conclusions and research methodologies used; (4) State the main research areas and topics and (5) List the research paradigms used in the articles. The systematic review of the literature shows concern in HEIs to promote quality education in general and the curricular accounting unit.

Keywords: Accounting Education, Higher Education, Accounting Teaching, Accounting Academic Performance, Competences, Motivations

1. Introduction

Currently, accounting has spread to all courses in the area of Management and Economics. However, it appears that students are not prepared for this curricular unit that is both interesting and complex. Its specificity leads to learning difficulties where everyone must assume their responsibilities, from the teacher who teaches to the student who learns.

Therefore, teachers must arouse curiosity about this topic in students, helping them learn that what seems difficult is not always the case. The most profoundly traditional teaching methods are not always the most attractive to the student. It is necessary to innovate in accounting, making it more attractive to the target audience.

Considering the above problem and its importance for universities in general and teachers and students in particular, this article aims to identify how the teaching of accounting has been taught in HEIs as it intends, through a systematic literature review based on articles published in journals in this thematic area, understand what the necessary skills that accounting students must have to be successful in learning this curricular unit are.

Students' approaches to the learning context and their perceptions are considered the primary influence on their success [1, 2]. According to Entwistle et al. [1], student learning is more affected by the perception of teaching than by the teaching methods themselves. In this context, teaching includes methods and a strong teacher-student interaction, which is fundamental to a good university learning environment [3, 4].

A fundamental principle of student-centred learning refers to the importance of being consulted about the teaching process of which they are an integral part, leaving the more traditional pedagogical approaches in which teaching was centred on the teacher, thus making the student more passive [5, 6].

Several research types have concluded that student involvement is one of the crucial aspects of their learning, directly influencing retention rates [7–9]. In this sense, if universities intend to improve retention rates and student satisfaction with the teaching-learning process, they need to pay more attention to students' real needs and expectations [6].

Ramsden and Entwistle [10] refer that the quality of teaching, in whatever area, is directly influenced by teachers' attitude. As a general rule, ineffective teachers promote discouragement of positive attitudes by students.

Students' educational experience and learning background have a substantial influence on their orientation to study [11, 12]. Some authors argue that the student's behavior concerning learning is strongly related to their motivation [13]. However, this also varies according to the learning field [14].

The literature identifies three approaches related to simple, profound and self-fulfilling approaches, being said that a student who takes a more straightforward approach is intrinsically motivated. One who takes a deeper approach is intrinsically motivated [15]. In the context of accounting, it is stated that students must first learn the terminology, basic concepts and procedures and only later can they use their new knowledge acquired according to the context in which they are inserted [16, 17].

In the context of the present research, it appears that the learning of accounting does not escape the rule of what has already been saying about perceptions, attitude, teacher involvement, student involvement and motivation. Accounting teaching is seen as essentially technical [18], which is an area that usually attracts a population with a more advanced academic level. It is recurrent that a graduate student reveals more significant difficulties in learning this subject than a graduate or master student [19]. Some studies reveal that there are some obstacles in the learning of this topic, where the absence of previous school bases, the inexperience resulting from the diversity of the student population, language barriers, socio-economic, cultural and educational contexts are highlighted. Oral and written communication skills are also considered fundamental to the success of accounting learning, and HEIs need to be concerned with finding ways to improve these capacities in order to obtain better future results [20–22].

These aspects can prove to be obstacles that increase the complexity of the learning environments in HEIs, posing problems related to heterogeneous competencies among students that directly influence learning [23]. In fact, a gap between students 'expectations and what they experience can result in students' resistance to accepting new teaching approaches, leading to less academic performance or even, in extreme cases, abandoning the institution [24, 25].

Universities are faced with the challenge of maintaining a balance between the products (courses) they offer and the actual preferences of their customers (students), trying to optimize this balance in order to remain in the market [26].

Concerning accounting, universities need to keep up-to-date by not shying away from the need to keep up with technological innovation that allows them to take a learning approach that complements traditional teaching [27].

In addition to increasing technological updating in accounting education, it is necessary to make it more practical, encouraging student participation in projects aimed at their learning in the field [28].

The accounting learning approach is influenced by how students view it and can be superficial or profound, leading to different learning outcomes making them capable of solving more or less complex problems as well as making them more or less capable of understanding the social and critical perspectives of accounting [29]. Some studies show that most accounting students learn only superficially this scientific field of knowledge, thus becoming less able to solve problems that prove to be more complex [30–33].

On the other hand, working in a team is acknowledged as a good accounting learning practice as the exchange of experiences and acquired knowledge allows students to improve their learning skills [34].

The present research intends to fill a gap found in the literature related to the fact that no systematic review of the literature has been found that focuses in detail on the teaching of accounting in HEIs and whose scientific publication has been carried out in one of the most important journals in this field of knowledge: Accounting Education.

2. Literature review

2.1 Accounting teaching and learning in higher education

Learning depends on the availability of time one gets assigned and the intellectual resources made available to achieve the expected results. In this sense, one of the main motivations of students is competitiveness with their colleagues [35]. As a result of several types of research, it was possible to identify the main aspects that influence learning, being the structure and relevance given to the contents [36], the conception of learning [37], motivation [38] and the approach to learning [36].

According to various researches, in order to be successful in accounting teaching and learning, several skills are needed, such as an excellent entrepreneurial spirit, good ability to solve practical problems, communication and interpersonal skills, good management and negotiation skills as well as an excellent theoretical background [39, 40]. In this sense, the skills of the professional who teaches and the student who learns must be much more than essentially technical, maturity, interpersonal effectiveness and general psychological well-being are necessary, not forgetting other essential aspects such as oral and written communication skills, sound reasoning and reasoning skills [39, 41].

From the students' point of view, academic success is of paramount importance, as the possibility of failure entails emotional and financial costs [42]. According to these authors, from the point of view of the HEIs, students' failure can promote discredit caused by high retention rates.

Marriott [43] refers that teachers who teach the curricular accounting units assume themselves as extrinsic motivators of their students in the sense of indicating the right path for learning, which, in the vast majority of cases, is essentially superficial. However, students' approaches to learning can be modified through new teaching strategies aimed at improving academic results, that is, teaching methods that are oriented towards a more practical component and more related to

the fundamental requirements of the accountant profession [44, 45]. In education in general and of accounting in particular, one of the main concerns is related to the apparent ineffectiveness of the teaching given in the HEIs, and this inefficiency is attributed to the lack of motivation shown by both teachers and students [46]. Bui and Porter [47] refer that in the teaching of accounting, the students lack the desired skills. However, the teachers' lack of time to devote the necessary energy to their teaching is also the problem, making it more stimulating and motivating. In turn, students also report some disappointment as they find that their teachers are not enthusiastic about teaching, which causes demotivation. The latter author mentions in his research that the students see the teacher's enthusiasm as essential to increase their intrinsic motivation in an indirect and extrinsic way directly, assuming itself as a preponderant factor in the evaluation of the quality and effectiveness of teaching. Another aspect mentioned in the literature is related to the gap between the expectations previously established by the students and the reality they encounter in the classroom environment [46].

Patel et al. [48] report in their research that accounting students are influenced by cultural and social factors that interfere with their ability to learn. In this sense, language-related barriers are also important in learning and can constitute obstacles to the interiorization of contents [49].

Students' experience throughout their academic career also influences their orientation towards study, making them more independent as a result of their greater adaptation to the academy in general and to the curricular units in learning in particular [50]. The same author states that the greater the educational experience of students, the less dependent they become on teacher-centred learning as a result of the number of years of presence in the academy. This conclusion is consistent with the research carried out by Lee and Lodewijks [51]. They concluded that students in their final year of university are more likely to change their learning approaches than their peers in the early years. Within this line of thought, several researchers refer that accounting students must experience rigorous and profound learning of topics to apprehend them consistently in the sense that, if they choose this field in the future, they become better professionals [52–54]. Despite considering the importance of rigor and deepening of learning in accounting, these same authors consider it is challenging to lead students to this intellectual aspiration, saying that it would be essential that this type of learning be experienced as early as the first years of higher education.

Turner and Baskerville [55] also concluded that a general change in accounting students' attitude, focusing on more profound and more rigorous learning in the first weeks of the course, allows you to provide them with a solid basis for their learning be more active and effective.

As research is a constant academic requirement, teachers inevitably have to pay attention to it, sometimes neglecting, even without any intention, the quality of their classes [56]. However, with the impact of accounting research less academically visible and therefore more difficult to value, as in other areas [57], this makes that in many cases, research related to this area does not become an asset that influences students, for research in accounting has been identified as a process that is excessively away from the practical reality that is the one which is more prevalent in the context of the teaching-learning process in HEIs [58].

2.2 Student learning skills and teacher teaching strategies -

Crawford et al. [59] refer in their research to the necessary skills that a student should have when entering the job market in the field of accounting and the skills that future employers expect them to have. In fact, knowledge of these skills is a

strong help for teachers to adapt their teaching methodologies to fulfill those needs. The study concluded that analytical, oral and writing skills are fundamental, so it should be easily seen that universities have every interest in moving in that direction.

In the context of accounting education, it appears that there is an effort aimed at encouraging students to greater participation through the construction of their knowledge and practices [48]. In this sense, accounting students, to achieve excellence goals, need to integrate and adapt to learning approaches that improve academic performance, progress and seek superior quality learning results [60–62].

Although students' efforts are crucial to their academic success, the importance of accounting teachers cannot be overlooked, who must, above all, be aware of the needs and difficulties of students in the classroom and outside the classroom [63]. The author mentions in his research that the program's quality, the methodology used, and the resources available prove to be fundamental for the improvement of the accounting learning environment.

Many studies related to teaching and learning focus on certain concrete aspects of teaching, such as strategies, skills and methodologies applied to each context [64]. However, according to these authors, education in general and its strategies, skills and methodologies applied in particular cannot be considered just as an isolated sequence in order to achieve particular objectives. Teaching should be seen as a set of relationships where changing one aspect necessarily requires changes in other aspects [62]. However, in the vast majority of cases, this aim is tough to achieve.

Regarding the methodologies preferred by students, studies show that students prefer expository classes, with step-by-step teaching, resolution of exercises and functional specification of content instead of other methodologies [62]. However, the various teaching methodologies are never completely good or bad, effective or ineffective, appropriate or inappropriate as they depend on several factors that affect the success of the teaching-learning process, such as teacher quality, content difficulty, classroom environment, school background, among others [65].

A single teaching method usually cannot create all the conditions effectively because each topic has its complexity and specificity. It is necessary to adapt to the best method for each situation. Teachers may find it impossible to adopt very sophisticated teaching strategies because the curricular unit is very specific, technical and sometimes also theoretical from a conceptual perspective [66].

In the era of digital technology, it becomes crucial to understand whether the teaching of accounting should initiate innovative changes in its methodology, trying to understand whether this change may or may not bring pedagogical complexities resulting from innovative approaches [67].

Owens and Price [68] found in their researches that the use of technologies is already so every day that, in the classroom, students already consider them as traditional teaching. For this reason, the authors question whether education has already reached a turning point and is on the threshold of being entirely transformed by innovative digital technologies that place it on the next level of qualitative evolution. However, according to Taylor and Newton [69], students are still not convinced that technology can improve their learning experience.

Several researchers say it is a significant challenge to adapt universities to new teaching methodological trends that increase student preferences and teacher motivation [70–72]. The truth is that many teachers remain accustomed to the usual routine, resisting the necessary change in the teaching paradigm [73–75], mainly ignoring the necessary change due to apparent lack of knowledge of new technologies [76].

Watty et al. [77], in their research, concluded that some professors are innovative in the application of new technologies. However, there are still many that prove to be inhibitors to their use. These authors discovered four factors that demonstrate resistance to the implementation of new technologies in the teaching of accounting. These factors are (1) resistance of the teaching staff - insofar as it appears that the teaching staff presents resistance to the use of new technologies due to the existence of opposition to the change in teaching methods. This resistance is due to the lack of knowledge/adaptation to the use of new technologies and also to the preference of teachers for more traditional teaching approaches; (2) Individual and solitary innovators - insofar as there are teachers who individually try to implement new technologies, being, in their curricular units, pioneers of innovation. However, they report that when they tried to implement new technologies, they felt strong resistance from their co-workers; (3) Comfort zone and generational attitudes - it appears that the teaching staff is resistant to the use of new technologies due to the existence of opposition to the change in teaching methods. This resistance is due to the lack of knowledge/adaptation to the use of new technologies and also to the preference of teachers for more traditional teaching approaches; (4) Lack of support from teaching staff – the lack of support from the rest of the faculty was found as a form of resistance to the adoption of new technologies. The lack of support is due to the lack of knowledge that some teachers reveal about the use of technology, the need to relearn and the fear of appearing incompetent for not knowing how to use these tools.; (5) Lack of time and overwork by the teaching staff - the teachers revealed that the immense workloads they have do not allow them to spend time learning new technologies that then allow them to have the background to use them properly in the teaching process learning in the classroom.

In line with the previous study, it can be said that while many teachers have been striving to improve the teaching and learning process, others remain stagnant and willing to keep everything as usual [73–75, 78–80].

Concerning accounting, the perception of researchers is the same. There are professors interested in being innovative [80] but many others in being inhibitors [73, 78, 81].

The curricular unit of accounting has been somewhat slow in adopting technologies that improve its results [80]. Although there is a growing effort to adopt technology in order to improve the teaching of accounting [82], such an objective remains limited in time and space [81, 83, 84].

In addition to all the aspects already mentioned, it is also interesting to address others explored by the literature that prove to be relevant to the topic highlighted here.

Student feedback is a crucial aspect of the teaching-learning process's success, whether in the area of accounting or any other area. Watty et al. [85] state in their studies that a meaningful way to improve the quality of accounting teachers' classes is related to the need to obtain student feedback regarding the whole process. The authors state that feedback allows students to identify the difference between their performance and their goals. Moreover, on the other hand, it allows students and teachers to adopt new methodologies and strategies of teaching and learning, respectively, in order to achieve the goals of better-quality teaching.

The uniformity of accounting education within a country or between different countries would also be relevant as it would allow an international student to learn this curricular unit in the same way as internal students, this proving to be a helpful teaching tool in order to be able to understand better the educational systems of accounting around the world [86].

The origin of the students who attend the curricular accounting unit is also of relevant analysis to understand the teaching problem of this curricular unit. There

are two types of students, those who bring secondary education bases and those whose bases are reduced or practically nil. There are students whose provenance is a professional education and brings many bases because they are directed to a more practical component and students from regular general education who do not have access to any accounting discipline. In that sense, Abhayawansa et al. [87] refer that students exposed to accounting learning before entering university usually achieve better academic results than the rest. This conclusion suggests the need for universities in general and teachers in the classroom to adopt mechanisms and methodologies that allow everyone to have access to learning in an integrated and sustained way, leaving no one behind [88].

The student's cultural background and knowledge of the literature also contribute to the improvement of skills in the area of accounting learning, since the original, creative, imaginative and multicultural thinking added to scientific rigor allows for more excellent reflection and the ability to apply the knowledge acquired in the university context [89].

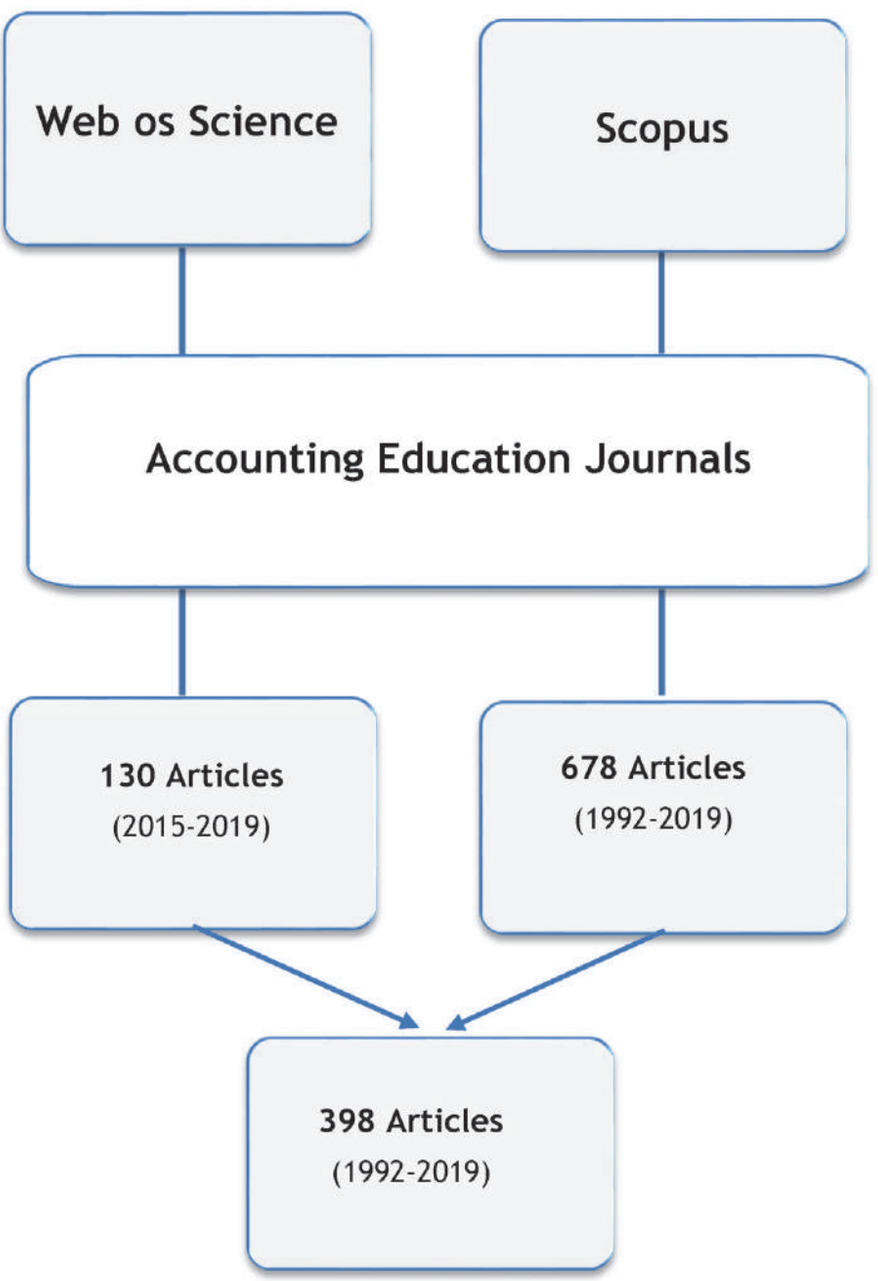

Figure 1.
Search criteria.

Students' initial choices when entering higher education also influence their future intention in a particular area, that is, a student who at the beginning of his academic life chooses accounting as one of his areas of choice maintains his dedication to this area typically, becomes a better professional, and his intention to pursue a career related to this topic increases [88].

Cooperative learning through the formation of working groups within the classroom can also condition learning. Suppose the teacher purposefully selects the working groups to promote the exchange of knowledge between the most prepared and the least prepared students. In that case, this increases learning by exchanging ideas and knowledge between students who are in different stages of learning with each other [90].

In the following chapters, the methodology that guided the present research is presented, followed by the same and respective conclusions.

3. Methodology

According to Barañano [91], the research method adopted was quantitative, confirmatory and descriptive research. This chapter describes the research process adopted, following the research process advised by Tranfield et al. [92]: (1) review planning; (2) systematic review; (3) review disclosure.

It was defined as a base research criterion that only articles published in the Accounting Education magazine and that was indexed in the ISI Web of Science and Scopus databases, whose abstract addressed accounting education in the context of HEIs, would be analyzed. In the initial search, 808 articles were found (130 in WOS and 678 in Scopus) published between 1992 and 2019. Duplicate articles were eliminated, abstracts of all articles were read, and only those that dealt with the topic of teaching accounting in HEIs were considered, leading to the exclusion of 410 articles that, despite dealing with the topic of accounting in general, did not deal with the topic of teaching accounting in HEIs. **Figure 1** shows the search criteria used in this study.

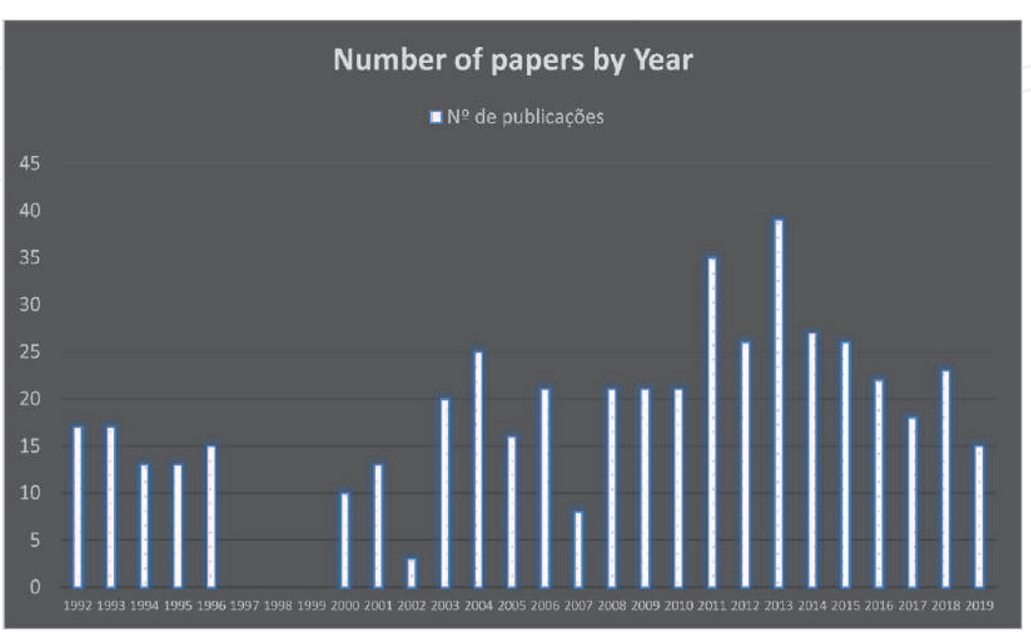

Figure 2.
Number of papers evolution (1992–2019).

4. Results

4.1 Final output (N = 398 articles)

4.1.1 Number of publications by year

The first and last research work published in Accounting Education on teaching accounting in HEIs was written by Wilson [93] and Coetzee et al. [94].

In the period between 1992 and 2019, which is the period in which the 398 articles included in this study are located, the number of publications varied, with the years 1997 to 1999 having the lowest number of publications (0) and the year 2013, which reached the highest number (39). Analyzing the period in question, we can say that from 2008 onwards, the number of publications was consistently above 20, except in 2019, which at the date of this research had not yet ended (**Figure 2**).

The years 2011 and 2013 were the most productive, with 35 and 39 articles published respectively.

4.1.2 Authors with five or more publications

As the primary author, the number of publications by each author, the analysis of the 485 articles in our database allows us to verify that there are 20 authors with five or more publications on teaching accounting in HEIs, totalling 147 articles from the complete database. The remaining 139 authors have between 1 and 4 articles published on average (**Figure 3**). The authors with the most significant number of publications are Jackling, Beverley F. (h-index 16); Marriott, Neil (h-index 9) and McHugh, Gerard (h-index 2).

4.1.3 Most covered areas of knowledge

There are several areas of knowledge in which research has focused, with Accounting Educations with 200 articles, Financial Accounting with 62 and International Accounting with 25 as the main areas.

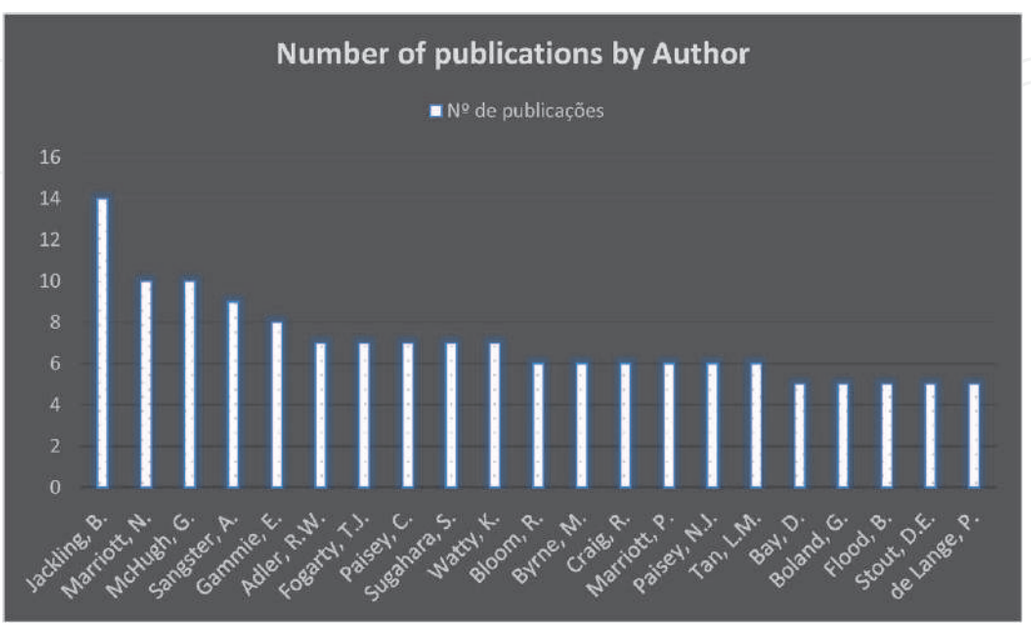

Figure 3.
Number of publications by author (1992–2019).

In **Figure 4**, we can observe the main areas of knowledge on which the research works published in the Accounting Education magazine focused.

4.1.4 Most covered topics

Regarding research topics, these are diverse, with the main topics related to academic performance (38 papers), the adoption of technologies in teaching (20 papers) and teaching methodologies (17 papers), among many others being highlighted, as we can see in **Figure 5**.

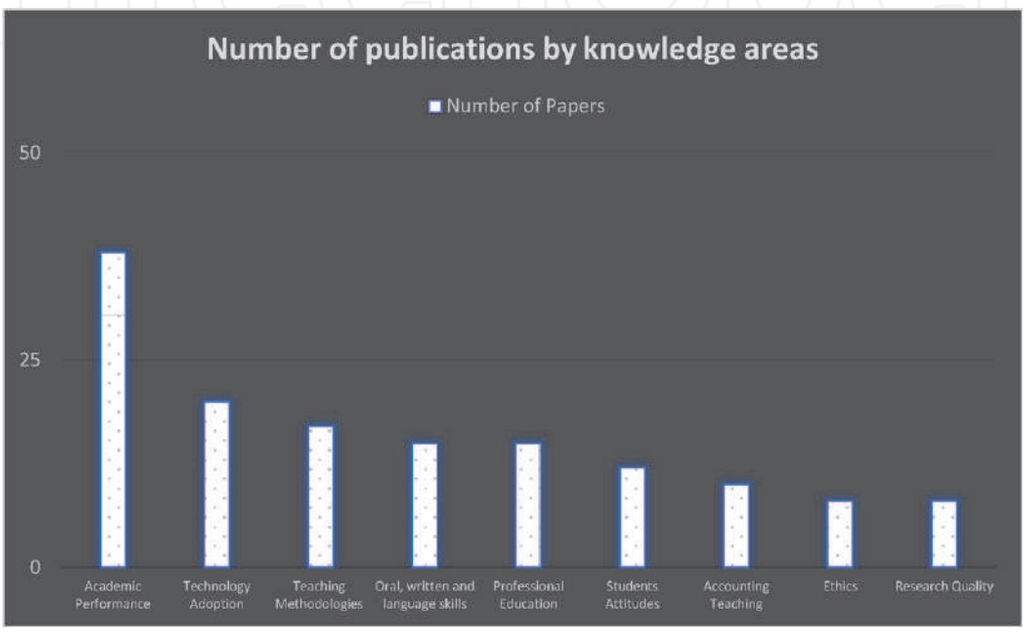

Figure 4.
Number of publications by knowledge areas (1992–2019).

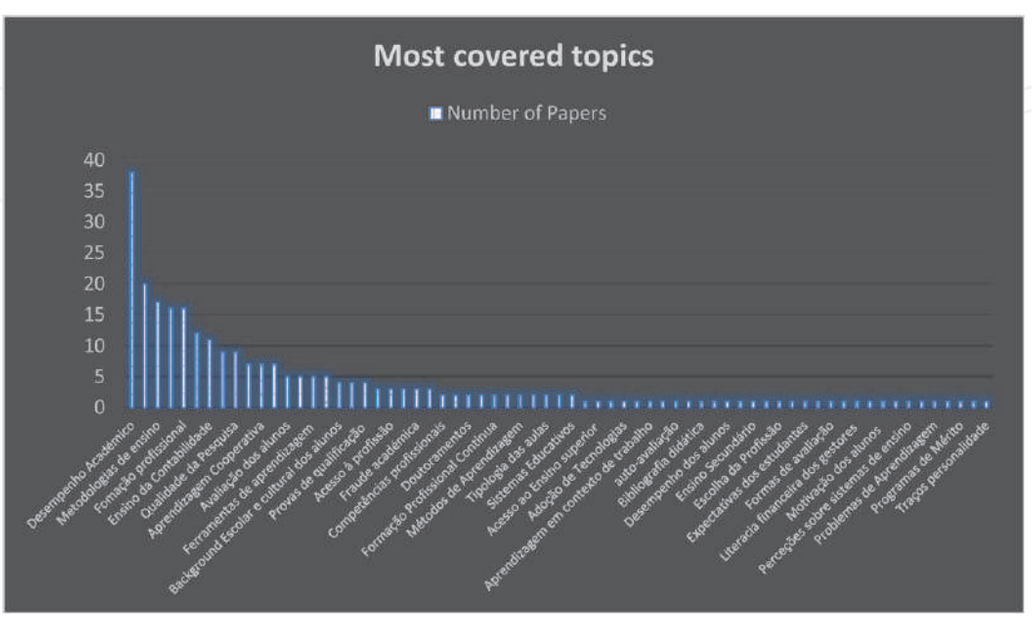

Figure 5.
Most covered topics (1992–2019).

4.2 Top 20

4.2.1 Main authors and respective citations

The criteria for presenting results that will be used from now on will be based on the 20 most cited articles. It was necessary to count the citations that occurred in WOS and SCOPUS and thus reach the 20 most cited articles in the totality of the two databases used. **Table 1** presents the TOP 20 most cited articles in the sum of both databases.

4.2.2 Structure and content of the TOP 20 articles

Table 2 presents the results extracted from the TOP 20, providing us with relevant information on the main empirical data resulting from the various investigations. Regarding the methodological dimension, the most general studies are quantitative with 55.3% of publications (16), followed by qualitative with 24.1% (7), then mixed methods and literature review have 10.3% (3) each of methodology predominance. Empirical studies with the application of surveys are the most used to research how accounting is taught at HEIs and the necessary skills that the professional in the area of accounting must have to be an effective teacher in higher education. Surveys were used in 15 articles (51.7%), interviews in 6 (20.7%), surveys and interviews in 4 (13.8%) and the remaining 4 (13.8%) were essentially theoretical without application of any inquiry and/or interview.

4.3 TOP 20 vs. *N* = 485

4.3.1 Main research topics

Regarding the main research topics covered in our research articles, the topic most addressed in the total output is that which is also the most researched in the Top 20. Then there are two topics (Adoption of Technologies and Teaching Methodologies) that are very much addressed in the final output that is not found in our Top 20. The topics located in the 4th and 6th positions of the complete database are also in the same position in our Top 20, together with the topics Cooperative Learning and School and students' cultural background. In **Table 3**, we can see the complete information of the general overview of the most discussed research topics.

4.3.2 Research paradigms (N = 398 vs. TOP 20)

For the classification of articles according to their paradigm, the study of Hopper and Powell [117], shown in **Figure 6**, which based on a structure defined by Burrell and Morgan [118], synthesized accounting research into a taxonomy based on two axes, where the researcher's variety of ontological and epistemological assumptions is represented on one axis and the assumptions about human nature and its relationship to social change are represented on the other axis.

A general analysis made to the final output of the 385 articles allowed us to verify that the main paradigms addressed are the Interpretative with 50% of the occurrences, followed by the positivist with 41%, with 8% we find articles with both approaches simultaneously and with 0.25% the critical paradigm. In the Top 20, we find that the positivist paradigm is the one that is used in most articles with 60% of occurrences, followed by articles with a positivist and interpretive paradigm simultaneously with 30% of occurrences, the interpretive paradigm with 9% and with 1% the critical paradigm.

Position	Authors	Paper Title	Total citations WOS	Total citations SCOPUS	Total citations WOS + SCOPUS
1°	Sangster [95]	You Cannot Judge a Book by Its Cover: The Problems with Journal Rankings	20	26	46
2°	Moya et al. [96]	Performance-based Incentives and the Behavior of Accounting Academics: Responding to Changes	14	17	31
3°	Dull et al. [97]	Achievement Goal Theory: The Relationship of Accounting Students' Goal Orientations with Self-efficacy, Anxiety, and Achievement	12	16	28
4°	Everaert et al. [98]	The relationship between motivation, learning approaches, academic performance and time spent	11	13	24
5°	Daly et al. [99]	Using Group Work to Develop Intercultural Skills in the Accounting Curriculum in Australia	11	13	24
6°	Rackliffe and Ragland [100]	Excel in the accounting curriculum: perceptions from accounting professors	9	12	21
7°	Spraakman et al. [101]	Employers' Perceptions of Information Technology Competency Requirements for Management Accounting Graduates	11	9	20
8°	Carenys and Moya [102]	Digital game-based learning in accounting and business education	7	12	19
9°	Levant et al. [103]	Business simulation as an active learning activity for developing soft skills	8	10	18
10°	Aldamen et al. [104]	Does Lecture Capturing Impact Student Performance and Attendance in an Introductory Accounting Course?	8	9	17
11°	Moore [105]	Exploring the Role of Symbolic Legitimation in Voluntary Journal List Adoption	8	9	17
12°	Webb and Chaffer [106]	The expectation performance gap in accounting education: a review of generic skills development in UK accounting degrees	6	11	17
13°	McGuigan [107]	The Impact of Journal Rankings on Australasian Accounting Education Scholarship - A Personal View	7	9	16
14°	Hussain et al. [108]	Journal Rankings, Collaborative Research and Publication Strategies: Evidence from China	7	8	15
15°	Marriott et al. [109]	Experiential Learning - A Case Study of the Use of Computerized	6	9	15

Position	Authors	Paper Title	Total citations WOS	Total citations SCOPUS	Total citations WOS + SCOPUS
		Stock Market Trading Simulation in Finance Education			
16°	Barac [110]	Helping Disadvantaged Students: Findings from the Thuthuka Programme	7	7	14
17°	Wen et al. [111]	Understanding the Intentions of Accounting Students in China to Pursue Certified Public Accountant Designation	7	6	13
18°	Ellington [112]	The impediments to the change to UK university accounting education, a comparison to the USA pathways commission	5	6	11
19°	Lindsay [113]	More than 'continuing professional development: a proposed new learning framework for professional accountants	5	6	11
20°	Cameron and O'Leary [114]	Improving Ethical Attitudes or Simply Teaching Ethical Codes? The Reality of Accounting Ethics Education	9	0	9

Table 1.
Authors and citations (Top 20).

Authors	Sample	Methodology	Review	Main conclusions
Sangster [95]	Not applicable (theoretical)	Qualitative	Accounting Education	The ranking lists of journals in the accounting area have an impact on the quality of accounting research. This means that often the inclusion of the word accounting leads authors to lower the magazines' ranking level.
Moya et al. [96]	Academic articles by Spanish authors on accounting for the period between 1996 and 2005.	Quantitative	Accounting Education	In view of the change in the regulation of publications in Spanish universities, these authors considered a decrease in publications, jeopardizing the relationship between research and professional practice. Additionally, they argued that this is because publication in indexed journals is favored exclusively.
Dull et al. [97]	521 students in the financial accounting course at a US public university.	Quantitative	Accounting Education	They argued that students' goals and their relationship to academic expectations, performance, self-efficacy and test anxiety have a positive relationship. However, the combination of mastery and motivation regarding performance goals can lead to better results in terms of course scores.

Authors	Sample	Methodology	Review	Main conclusions
Everaert et al. [98]	388 1st year students of a degree in economics and administration from a university in Belgium	Quantitative	Accounting Education	Accounting students can opt for deep or superficial learning. In the study, they concluded that most students opt for deep learning over superficial learning, which is motivated by their motivation to learn, their gender, their skills, and the time they intend to spend studying. This option leads to higher academic performance.
Daly et al. [99]	192 international students studying at an Australian university	Quantitative	Accounting Education	Learning based on working alliances between students from different cultural backgrounds allows for a very positive multicultural exchange and higher learning levels compared to control groups. The students participating in these alliances showed higher learning levels of the contents and cultural increases resulting from the exchange of experiences with their colleagues from other nationalities. It is also concluded that accounting students' intercultural learning is fundamental for their future globalized labour market.
Ramachandran et al. [115]	Accounting teachers and of other similar areas	Quantitative	Accounting Education	Most of these teachers use Excel to teach their classes. However, students often do not show skills to work in the classroom with this software. This means that there are still disconnects between teachers and students' skills regarding the use of computer tools in class.
Spraakman et al. [101]	Senior financial advisers and their subordinates in large New Zealand companies.	Qualitative	Accounting Education	They concluded that technology and information tools are crucial for accounting and finance professionals. Their findings explicitly provide information that accounting teachers should integrate the use of these tools in their programs.
Carenys et al. [116]	Not applicable (theoretical)	Literature review	Accounting Education	The results allow us to understand better the effectiveness of using games in these areas.
[103]	Undergraduate and postgraduate students from the university campuses of Paris, Nice and Lille, to apply a business simulator	Quantitative	Accounting Education	They concluded that the skills and abilities of students in the use of the simulator are influenced by the ethnic, cultural and professional experience of the students and that it also requires that there be sharing of practices in a context of global education.
Aldamen et al. [104]	254 students in the first year of the introduction	Quantitative	Accounting Education	There is a weak positive relationship between capture/attention and the performance obtained with the use

Authors	Sample	Methodology	Review	Main conclusions
	to financial accounting course in Qatar.			of lectures, mainly taking into account the variables: average grades, frequency, gender and age. However, students with good performance value these lectures as an efficient pedagogical resource, in contrast to students with lower performance.
Moore [105]	Not applicable (theoretical)	Qualitative	Accounting Education	They concluded, with some caution, that issues of symbolic legitimation in assessing the quality of research can play a crucial role in the processes of listing and classification of journals.
Webb and Chaffer [106]	Application of questionnaires to CIMA interns at UK (valid answers = 1655)	Quantitative	Accounting Education	In order to gain an understanding of how accounting courses are geared towards the professional requirements of the market, they concluded that there is still a need to improve, at the level of students, their oral communication skills, their global view on the organization, their ability to resilience and their ethical conscience.
McGuigan [107]	University and accounting teachers	Quantitative	Accounting Education	The ranking of the journals where scientific articles are published is seen as the main measure of academic performance in the area of accounting. The article concludes that this narrow measurement approach must be abandoned in order to encourage creativity and innovation in business research in order to solve the really important problems that we face in the present and that we will have to face in the future.
Hussain et al. [108]	200 participants at an international symposium at Shanghai University of Finance and Economics	Mixed (quantitative and qualitative)	Accounting Education	Most respondents of Chinese origin use the ranking list of the university's own magazines to assess their quality; However, this option generated conflicts for 73% of the interviewees when collaborating with other academics from other universities due to the variation in the classification criteria of the journals being different.
Marriott et al. [109]	97 UK universities with higher education programs in finance.	Mixed (quantitative and qualitative)	Accounting Education	There is effectiveness when presenting educational simulators for the student and the teacher, which leads to a better understanding of the complex concepts inherent in the area of finance.
Barac [110]	12 students from a	Qualitative	Accounting Education	The characteristics of a support program, which involves the various

Authors	Sample	Methodology	Review	Main conclusions
	university in Africa			interested parties, which aims to help socioeconomically most disadvantaged students to study and simultaneously have a job are fundamental to their success, both academic and professional These support programs are essential so that students can more easily enter the restricted labour market.
Wen et al. [111]	288 accounting students (undergraduate and masters)	Quantitative	Accounting Education	There is a genuine interest in obtaining the title of certified accountant by students, in view of the prospect of becoming independent professionals in the labour market and the influences of professionals of excellence in the area.
Ellington [112]	Theoretical	Qualitative	Accounting Education	By comparing US and UK universities with respect to the changes that business environments demand, they concluded that UK universities should change their programs in accordance with accounting bodies, institutional policies and the identity of professors of universities.
Lindsay [113]	Theoretical	Qualitative	Accounting Education	Through the development of a holistic and interactive framework, they have helped accounting bodies and accounting professors to interact and train future accounting professionals
Cameron e O'Leary [114]	Senior year students of accounting	Quantitative	Accounting Education	Regarding the sensitivity that students have about ethical, moral and legal issues and attitudes and their effectiveness in the accounting area, they concluded that training in accounting ethics needs to be reassessed for it to be effective.

Table 2.
Overview of the main conclusions of published articles on teaching accounting in HEIs - Top 20.

Tables 4–7 shows the unit of analysis of the articles (Students /Teachers / Students and Teachers/Others), the research paradigms used (Positivist, Interpretative), that is, the theoretical and methodological frameworks for interpreting the phenomena used by the researchers, as well as the essential topics addressed by the authors and the respective authors of the scientific articles that addressed them are also presented.

Analyzing the articles that focus on the "Students" analysis unit, we verified the existence of positivist articles (8 articles) and only 1 interpretative positivist article. Concerning the "Teachers" analysis unit, we found that the positivist nature (5 articles) and the positivist/interpretative nature (3 articles) simultaneously in the same article are the observed paradigms. The topic of analysis, "Academic Performance" and the one with the most significant number of articles, is the topic whose

Thematic	Final Output (N = 398)	Top 20
Academic Achievement	**38**	4
Adoption of Technologies	**20**	X
Teaching methodologies	**17**	X
Oral, written and linguistic skills	**16**	3
Professional qualification	**16**	X
Student Attitudes	**12**	3
Accounting Teaching	**11**	X
Ethics	**9**	X
Research Quality	**9**	X
Curricular Adjustment	**7**	X
Cooperative Learning	**7**	3
International Accounting Standards	**7**	X
Student evaluation	**5**	X
Curricular internships	**5**	2
Learning Tools	**5**	X
Using Multiple Choices	**5**	X
School and cultural background of students	**4**	3
Challenges for teachers	**4**	X
Qualification tests	**4**	X
Access to Profession	**3**	X
Student Choices	**3**	1
Academic fraud	**3**	X
Information systems	**3**	X
Professional skills	**2**	X
Professional commitment	**2**	X
Ph.Ds	**2**	X
Choice of Magazines	**2**	X
Continuing Professional Training	**2**	X
International Education Standards (IES)	**2**	X
Learning Methods	**2**	X
Plagiarism	**2**	X
Typology of classes	**2**	X
Quality of teaching	**2**	X
Education Systems	**2**	X
School dropout	**1**	X
Access to Higher Education	**1**	X
Accreditation of courses	**1**	X
Adoption of Technologies	**1**	X
Professional affiliation	**1**	X

Thematic	Final Output (N = 398)	Top 20
Work-based learning	**1**	X
Evaluation activities	**1**	X
self-evaluation	**1**	X
Performance evaluation	**1**	X
Didactic Bibliography	**1**	X
Curriculum	**1**	X
Student performance	**1**	X
Employability skills	**1**	X
High school	**1**	X
Student involvement in learning	**1**	X
Choice of Profession	**1**	X
Professional Exams	**1**	X
Student expectations	**1**	X
Instructional feedback	**1**	1
Assessment methods	**1**	X
Accounting research	**1**	X
Financial literacy of managers	**1**	X
Mentoring	**1**	X
Student motivation	**1**	X
School Organization	**1**	X
Perceptions about education systems	**1**	X
First job	**1**	X
Learning Problems	**1**	X
Support programs	**1**	X
Merit Programs	**1**	X
Problem-solving	**1**	X
Personality traits	**1**	X

Table 3.
Main research topics: TOP 20 vs. N = 485.

research approach differs concerning the paradigms used. It appears that the approaches were different between different authors on the same topic. Three articles each follow the research topics Students' attitudes; School and cultural background of students. Cooperative learning; Oral, written and linguistic skills and Challenges for teachers (**Table 4**).

By analyzing **Table 5**, we can see that, concerning the articles that focus on the "Teachers" analysis unit, it is verified that the positivist nature leads with 5 articles, followed by the positivist and interpretative nature with 3 articles, not finding articles of only interpretive nature. The topic with the most significant number of published articles is the topic "Challenges for teachers" with three articles, followed by "Typology of classes" and "Adoption of technologies" with 2 articles each.

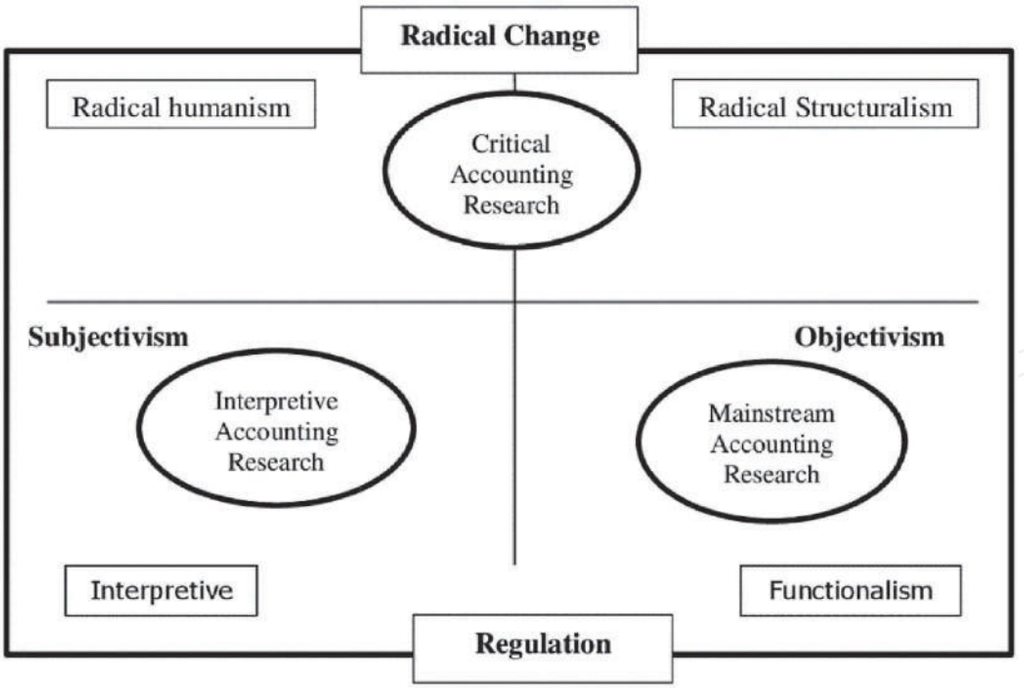

Figure 6.
Taxonomy of accounting research. Adapted from: Hopper and Powell [117].

Analysis Unit	Research Paradigms	Topics covered	Author (s) and Year
Students	**Positivist**	Student Choices	[111]
		Student attitudes	[104, 97, 98]
		Feedback	[111]
		Academic achievement	[107, 111, 97, 106]
		Curricular internships	[111, 106]
		School and cultural background of students	[104, 114, 98]
		Cooperative learning	[99, 104, 98]
		Oral, written and language skills	[104, 98, 106]
	Positivist e Interpretative	School and cultural background of students	[103]

Table 4.
Research paradigms and topics addressed - analysis unit: students.

By analyzing **Table 6**, we can see that in relation to the articles that focus on the unit of analysis, "Students and Teachers", there is only interpretative nature (2 articles).

By analyzing **Table 7**, we can see that concerning the articles that focus on the analysis unit "Other topics", there is a predominance of articles with a critical nature (3 articles), followed by a positivist and interpretive nature with 1 article each.

Analyzing the topics covered in the articles, we can see that the vast majority are centred only on the student. However, there are also topics centred on the teacher and other topics that are not centred on the student or the teacher. The most addressed topics are academic performance (4 articles), followed by the research

Analysis Unit	Research Paradigms	Topics covered	Author (s) and Year
Teachers	**Positivist**	Continuing professional training	[113]
		Challenges for teachers	[109, 106, 100]
		Typology of classes	[109, 112]
	Positivist e Interpretative	Technologies Adoption	[101, 103]
		Support programs	[110]

Table 5.
Research paradigms and topics addressed - analysis unit: teachers.

Analysis Unit	Research Paradigms	Topics covered	Author (s) and Year
Students and Teachers	**Interpretative**	Learning Tools	[103, 100]

Table 6.
Research paradigms and topics addressed - analysis unit: students and teachers.

Analysis Unit	Research Paradigms	Topics covered	Author (s) and Year
Others	**Positivist**	Ethics	[114]
	Interpretative	Quality of research	[105]
	Critic	Choice of quality magazines	[95, 108, 96]

Table 7.
Research paradigms and topics addressed - analysis unit: others.

topics “Students’ attitudes”;” School and cultural background of students”; “Cooperative learning”; “Oral, written and linguistic skills” and “Challenges for teachers” with 3 articles each.

5. Conclusions

This systematic review of the literature was directed solely and exclusively to the magazine Accounting Education to identify articles published over 28 years of scientific contribution to knowledge evolution. We identified how many studies related to the Teaching of Accounting in Higher Education Institutions (HEIs) had been published in the Accounting Education magazine since the journal started its scientific activity. We proposed a ranking of articles based on the volume of citations in the WOS and SCOPUS databases. We described the main conclusions and research methodologies used in the TOP 20, described the main research topics and described the research paradigms used in the articles. This issue of the epistemological paradigms used by accounting researchers is relevant and rarely addressed in the literature, being a significant contribution. Based on the results found, we verified that most of the studies carried out used quantitative and qualitative research methodology, which reveals the robustness of the researches carried out, the relevance of the conclusions drawn from each study and the contribution of each research to the increase of knowledge on this thematic area. The systematic review of the literature carried out shows concern in HEIs to promote quality education in general and the curricular accounting unit. It was found that the vast majority of concerns inherent to the research of this topic are encompassed in the students’ skills, teaching methodologies and teaching-learning strategies. It was also

found that teachers and students' intrinsic and extrinsic motivation are preponderant for increasing commitment and dedication to the accounting area. The way students approach learning, superficial or deep, is also a determining factor for their academic success and professional future in the field.

It was also possible to identify several research areas and topics on which the teaching of accounting in the HEIs is approached, such as the students' school background, oral, written and linguistic skills, cooperative learning, curricular internships, adoption of technologies, among other particular topics of interest, explained throughout this research, for the understanding of the phenomenon under study.

It appears that over the past 28 years, the research on teaching accounting published in this journal is related to good teaching practices, both methodologically. In terms of the skills of those who teach and those who learn, an evolution in the quality of teaching occurring. Researchers' effort has promoted and relaunched the curricular accounting unit to a level of excellence both in research and in the quality of teaching by teachers and learning by students. HEIs and their entire hierarchical organization, with their support and strategic plans, have contributed a lot to make the success and continuous improvement of accounting education in HEIs a reality. The present research is thus able to fill a gap found in the literature by focusing only on one journal, which is a reference in the area of accounting education, summarizing the main published studies on the subject under analysis, enumerating the main topics addressed by the researchers and enunciating the epistemological research paradigms that guided each research. Based on the results found, this article identifies research paths that can be explored to provide greater consistency and substantially increase the theoretical and empirical knowledge related to the teaching of accounting in HEIs.

Acknowledgements

This work of author Rui Silva is supported by national funds through the FCT – Portuguese Foundation for Science and Technology under the project UIDB/04011/2020 and the work from author Maria do Céu Alves is supported by national funds through the FCT – Portuguese Foundation for Science and Technology under the project (UIDB/04630/2020).

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References

[1] N. Entwistle, V. McCune, and J. Hounsell, "Approaches to studying and perceptions of university teaching-learning environments: Concepts, measures and preliminary findings," *Occas. Rep.*, vol. 1, 2002.

[2] T. Hassall and J. Joyce, "Approaches to learning of management accounting students," Educ. Train., vol. 43, no. 3, pp. 145–153, 2001.

[3] C. Asmar, E. Proude, and L. Inge, "'Unwelcome sisters?' An analysis of findings from a study of how Muslim women (and Muslim men) experience university," Aust. J. Educ., vol. 48, no. 1, pp. 47–63, 2004.

[4] W. Tan and K. Simpson, "Overseas educational experience of Chinese students: An evaluation of service quality experience in New Zealand," J. Res. Int. Educ., vol. 7, no. 1, pp. 93–112, 2008.

[5] J. Biggs, "What the student does: Teaching for enhanced learning," High. Educ. Res. Dev., vol. 18, no. 1, pp. 57–75, 1999.

[6] S. J. Lea, D. Stephenson, and J. Troy, "Higher education students' attitudes to student-centred learning: beyond'educational bulimia'?," Stud. High. Educ., vol. 28, no. 3, pp. 321–334, 2003.

[7] M. D. Boston and M. S. Smith, "Transforming secondary mathematics teaching: Increasing the cognitive demands of instructional tasks used in teachers' classrooms," J. Res. Math. Educ., pp. 119–156, 2009.

[8] S. Martin and J. T. Scott, "The nature of innovation market failure and the design of public support for private innovation," Res. Policy, vol. 29, no. 4–5, pp. 437–447, 2000.

[9] G. Scott, *Accessing the Student Voice: Using CEQuery to Identify what Retains Students and Promotes Engagement in Productive Learning in Australian Higher Education: Final Report*. Department of Education, Science and Training, 2006.

[10] P. Ramsden and N. J. Entwistle, "EFFECTS OF ACADEMIC DEPARTMENTS ON STUDENTS'APPROACHES TO STUDYING," Br. J. Educ. Psychol., vol. 51, no. 3, pp. 368–383, 1981.

[11] F. Dochy, C. De Rijdt, and W. Dyck, "Cognitive prerequisites and learning how far have we progressed since bloom? Implications for educational practice and teaching," Act. Learn. High. Educ., vol. 3, no. 3, pp. 265–284, 2002.

[12] S. Honkimäki, "Tynj{ä}l{ä}, P.-Valkonen, S.(2004): University students' study orientations, learning experiences and study success in innovative courses," Stud. High. Educ., vol. 29, no. 4, pp. 431–449, 2004.

[13] H. Christie, L. Tett, V. E. Cree, J. Hounsell, and V. McCune, "'A real rollercoaster of confidence and emotions': Learning to be a university student," Stud. High. Educ., vol. 33, no. 5, pp. 567–581, 2008.

[14] A. Heikkilä and K. Lonka, "Studying in higher education: students' approaches to learning, self-regulation, and cognitive strategies," Stud. High. Educ., vol. 31, no. 1, pp. 99–117, 2006.

[15] J. H. F. Meyer, "The modelling of 'dissonant' study orchestration in higher education," Eur. J. Psychol. Educ., vol. 15, no. 1, pp. 5–18, 2000.

[16] M. Hall*, A. Ramsay, and J. Raven, "Changing the learning environment to promote deep learning approaches in

first-year accounting students," Account. Educ., vol. 13, no. 4, pp. 489–505, 2004.

[17] D. Watkins and J. Hattie, "Individual and contextual differences in the approaches to learning of Australian secondary school students," Educ. Psychol., vol. 10, no. 4, pp. 333–342, 1990.

[18] B. Flood and R. M. S. Wilson, "An exploration of the learning approaches of prospective professional accountants in Ireland," in Accounting Forum, 2008, vol. 32, no. 3, pp. 225–239.

[19] V. Beattie IV, B. Collins, and B. Mcinnes, "Deep and surface learning: a simple or simplistic dichotomy?," Account. Educ., vol. 6, no. 1, pp. 1–12, 1997.

[20] W. S. Albrecht and R. J. Sack, *Accounting education: Charting the course through a perilous future*, vol. 16. American Accounting Association Sarasota, FL, 2000.

[21] T. Hassall, J. Joyce, M. D. Bramhall, I. M. Robinson, and J. L. Arquero, "The sound of silence? A comparative study of the barriers to communication skills development in accounting and engineering students," Ind. High. Educ., vol. 19, no. 5, pp. 392–398, 2005.

[22] M. Loureiro, N. Loureiro, and R. Silva, "Differences of Gender in Oral and Written Communication Apprehension of University Students," *Educ. Sci.*, vol. 10, no. 12, 2020.

[23] M. Byrne and B. Flood, "A study of accounting students' motives, expectations and preparedness for higher education," J. Furth. High. Educ., vol. 29, no. 2, pp. 111–124, 2005.

[24] S. M. Kift, K. J. Nelson, and J. A. Clarke, "Transition pedagogy: a third generation approach to FYE: a case study of policy and practice for the higher education sector," Int. J. First Year High. Educ., vol. 1, no. 1, pp. 1–20, 2010.

[25] V. Sheridan and S. Dunne, "The bigger picture: undergraduate voices reflecting on academic transition in an Irish university," Innov. Educ. Teach. Int., vol. 49, no. 3, pp. 237–247, 2012.

[26] A. Cook and J. Leckey, "Do Expectations Meet Reality? A survey of changes in first-year student opinion," J. Furth. High. Educ., vol. 23, no. 2, pp. 157–171, 1999.

[27] R. H. Taplin, R. Kerr, and A. M. Brown, "Opportunity costs associated with the provision of student services: A case study of web-based lecture technology," High. Educ., vol. 68, no. 1, pp. 15–28, 2014.

[28] C. Farrow, "Pathways for chartered accountants in the 21st century," Emerg. pathways next Gener. accountants, vol. 3, pp. 35–45, 2012.

[29] G. Boyce, S. Greer, B. Blair, and C. Davids, "Expanding the horizons of accounting education: Incorporating social and critical perspectives," Account. Educ., vol. 21, no. 1, pp. 47–74, 2012.

[30] P. Andon, K. M. Chong, and P. Roebuck, "Personality preferences of accounting and non-accounting graduates seeking to enter the accounting profession," Crit. Perspect. Account., vol. 21, no. 4, pp. 253–265, 2010.

[31] P. Booth, P. Luckett, and R. Mladenovic, "The quality of learning in accounting education: the impact of approaches to learning on academic performance," Account. Educ., vol. 8, no. 4, pp. 277–300, 1999.

[32] M. Byrne, B. Flood, and P. Willis, "An Inter-Institutional Exploration of the Learning Approaches of Students

Studying Accounting.," Int. J. Teach. Learn. High. Educ., vol. 20, no. 2, pp. 155–167, 2009.

[33] M. Baeten, E. Kyndt, K. Struyven, and F. Dochy, "Using student-centred learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness," Educ. Res. Rev., vol. 5, no. 3, pp. 243–260, 2010.

[34] J. Freeman, R. Dale, and T. Farmer, "Hand in motion reveals mind in motion," Front. Psychol., vol. 2, p. 59, 2011.

[35] N. Entwistle, "Motivational factors in students' approaches to learning," in *Learning strategies and learning styles*, Springer, 1988, pp. 21–51.

[36] F. Marton and S. A. Booth, *Learning and awareness*. Psychology Press, 1997.

[37] F. Marton, G. Dall'Alba, and E. Beaty, "Subject:[IFETS-DISCUSSION: 2499] RE: IFETS-DISCUSSION digest 322 From: Jennie Swann (swann_j@ usp. ac. fj) Date: Wed 31 Oct 2001-21: 40: 16 MET," Int. J. Educ. Res., vol. 19, pp. 277–300, 1993.

[38] A. Fransson, "On qualitative differences in learning: IV—Effects of intrinsic motivation and extrinsic test anxiety on process and outcome," Br. J. Educ. Psychol., vol. 47, no. 3, pp. 244–257, 1977.

[39] G. Boyce, S. Williams, A. Kelly, and H. Yee, "Fostering deep and elaborative learning and generic (soft) skill development: the strategic use of case studies in accounting education," Account. Educ., vol. 10, no. 1, pp. 37–60, 2001.

[40] M. Broad, M. Matthews, and A. McDonald, "Accounting education through an online-supported virtual learning environment," Act. Learn. High. Educ., vol. 5, no. 2, pp. 135–151, 2004.

[41] T. Davenport, S. Jarvenpaa, and M. Beers, "Improving knowledge work processes," Sloan Manage. Rev., vol. 37, pp. 53–66, 1996.

[42] L. Gracia and E. Jenkins, "A quantitative exploration of student performance on an undergraduate accounting programme of study," Account. Educ., vol. 12, no. 1, pp. 15–32, 2003.

[43] N. Marriott*, "Using computerized business simulations and spreadsheet models in accounting education: a case study," Account. Educ., vol. 13, no. sup1, pp. 55–70, 2004.

[44] J. Cullen*, S. Richardson, and R. O'Brien, "Exploring the teaching potential of empirically-based case studies," Account. Educ., vol. 13, no. 2, pp. 251–266, 2004.

[45] A. Manninen, *Knowledge in Accounting: An Applied Phenomenological Perspective*, vol. 24. University of Jyv{ä} skyl{ä}, 1994.

[46] G. Wong, B. J. Cooper, and S. Dellaportas, "Chinese students' perceptions of the teaching in an Australian accounting programme–an exploratory study," Account. Educ., vol. 24, no. 4, pp. 318–340, 2015.

[47] B. Bui and B. Porter, "The expectation-performance gap in accounting education: an exploratory study," Account. Educ. an Int. J., vol. 19, no. 1–2, pp. 23–50, 2010.

[48] C. Patel, B. Millanta, and D. Tweedie, "Is international accounting education delivering pedagogical value? ," *Account. Educ.*, vol. 25, no. 3, 2016.

[49] T. A. Ulrich, A. R. Michenzi, and W. E. Blouch, "CPAs assess the development of professional skills of

recent accounting graduates," J. Acad. Bus. Educ., vol. 4, no. 3, pp. 126–137, 2003.

[50] P. Ramsden, *Learning to teach in higher education*. Routledge, 2003.

[51] K. Lee and H. G. L. C. Lodewijks, "The adaptation of international students' learning styles to different learning contexts.," *Coll. Stud. J.*, 1995.

[52] J. A. Ballantine, A. Duff, and P. M. Larres, "Accounting and business students' approaches to learning: A longitudinal study," J. Account. Educ., vol. 26, no. 4, pp. 188–201, 2008.

[53] T. Y. Liu and Y. L. Chu, "Using ubiquitous games in an English listening and speaking course: Impact on learning outcomes and motivation," Comput. Educ., vol. 55, no. 2, pp. 630–643, 2010.

[54] L. English, P. Luckett, and R. Mladenovic*, "Encouraging a deep approach to learning through curriculum design," Account. Educ., vol. 13, no. 4, pp. 461–488, 2004.

[55] M. Turner and R. Baskerville, "The Experience of Deep Learning by Accounting Students," *Account. Educ.*, vol. 22, no. 6, 2013.

[56] S. Wright, K. Chalmers, and others, "The future for accounting academics in Australia," 2010.

[57] C. Tilt, "The impact of academic accounting research on professional practice," Account. Educ. a Crossroad, vol. 2070, pp. 35–40, 2010.

[58] B. Singleton-Green, "The communication gap: why doesn't accounting research make a greater contribution to debates on accounting policy?," Account. Eur., vol. 7, no. 2, pp. 129–145, 2010.

[59] L. Crawford, C. Helliar, and E. A. Monk, "Generic skills in audit education," *Account. Educ.*, vol. 20, no. 2, 2011.

[60] P. de Lange* and F. Mavondo, "Gender and motivational differences in approaches to learning by a cohort of open learning students," Account. Educ., vol. 13, no. 4, pp. 431–448, 2004.

[61] A. Duff, "The role of cognitive learning styles in accounting education: developing learning competencies," J. Account. Educ., vol. 22, no. 1, pp. 29–52, 2004.

[62] B. R. Lord and J. Robertson, "Students' experiences of learning in a third-year management accounting class: Evidence from New Zealand," Account. Educ. an Int. J., vol. 15, no. 01, pp. 41–59, 2006.

[63] D. Brown and M. Warschauer, "From the university to the elementary classroom: Students' experiences in learning to integrate technology in instruction," *J. Technol. Teach. Educ.*, vol. 14, no. 3, p. 599, 2006.

[64] K. L. Hillenburg, R. A. Cederberg, S. A. Gray, C. L. Hurst, G. K. Johnson, and B. J. Potter, "E-learning and the future of dental education: opinions of administrators and information technology specialists," Eur. J. Dent. Educ., vol. 10, no. 3, pp. 169–177, 2006.

[65] S. E. Bonner, "Choosing teaching methods based on learning objectives: An integrative framework," Issues Account. Educ., vol. 14, no. 1, pp. 11–15, 1999.

[66] L. Leveson, "The things that count: negative perceptions of the teaching environment among university academics," Int. J. Educ. Manag., vol. 18, no. 6, pp. 368–373, 2004.

[67] C. J. Bonk, K.-J. Kim, and T. Zeng, "Future directions of blended learning in higher education and workplace learning settings," Handb. blended

Learn. Glob. Perspect. local Des., pp. 550–567, 2006.

[68] J. D. Owens and L. Price, "Is e-learning replacing the traditional lecture?," Educ. Train., vol. 52, no. 2, pp. 128–139, 2010.

[69] J. A. Taylor and D. Newton, "Beyond blended learning: A case study of institutional change at an Australian regional university," Internet High. Educ., vol. 18, pp. 54–60, 2013.

[70] G. Kregor, M. Breslin, and W. Fountain, "Experience and beliefs of technology users at an Australian university: Keys to maximising e-learning potential," *Australas. J. Educ. Technol.*, vol. 28, no. 8, 2012.

[71] F. C. Saunders and A. W. Gale, "Digital or didactic: Using learning technology to confront the challenge of large cohort teaching," Br. J. Educ. Technol., vol. 43, no. 6, pp. 847–858, 2012.

[72] S. D. Smith and J. B. Caruso, *The ECAR study of undergraduate students and information technology, 2010*. Educause Colorado, 2010.

[73] F. Blin and M. Munro, "Why hasn't technology disrupted academics' teaching practices? Understanding resistance to change through the lens of activity theory," Comput. Educ., vol. 50, no. 2, pp. 475–490, 2008.

[74] G. Conole, "E-learning: The hype and the reality," J. Interact. Media Educ., vol. 2004, no. 2, 2004.

[75] N. Selwyn, "The use of computer technology in university teaching and learning: a critical perspective," J. Comput. Assist. Learn., vol. 23, no. 2, pp. 83–94, 2007.

[76] C. C. Lewis, C. E. Fretwell, J. Ryan, and J. B. Parham, "Faculty Use of Established and Emerging Technologies in Higher Education: A Unified Theory of Acceptance and Use of Technology Perspective.," Int. J. High. Educ., vol. 2, no. 2, pp. 22–34, 2013.

[77] K. Watty, J. McKay, and L. Ngo, "Innovators or inhibitors? Accounting faculty resistance to new educational technologies in higher education," J. Account. Educ., vol. 36, pp. 1–15, 2016.

[78] G. Kirkup and A. Kirkwood, "Information and communications technologies (ICT) in higher education teaching—a tale of gradualism rather than revolution," Learn. Media Technol., vol. 30, no. 2, pp. 185–199, 2005.

[79] J. Paver, D. A. Walker, and W.-C. Hung, "Factors that predict the integration of technology for instruction by community college adjunct faculty," Community Coll. J. Res. Pract., vol. 38, no. 1, pp. 68–85, 2014.

[80] E. Zarei, E. F. Kargar, and S. Bazyar, "The level at which accounting professors use information technology at universities," J. Account. Res., vol. 4, no. 2, pp. 159–174, 2014.

[81] R. Senik and M. Broad, "Information technology skills development for accounting graduates: Intervening conditions.," Int. Educ. Stud., vol. 4, no. 2, pp. 105–110, 2011.

[82] P. McCourt Larres, J. Ballantine, and M. Whittington, "Evaluating the validity of self-assessment: measuring computer literacy among entry-level undergraduates within accounting degree programmes at two UK universities," Account. Educ., vol. 12, no. 2, pp. 97–112, 2003.

[83] G. Jones and A. Abraham, "Education implications of the changing role of accountants: perceptions of practitioners, academics and students," 2007.

[84] Z. J. Lin, X. Xiong, and M. Liu, "Knowledge base and skill development in accounting education: Evidence from China," J. Account. Educ., vol. 23, no. 3, pp. 149–169, 2005.

[85] K. Watty, P. de Lange, R. Carr, B. O'Connell, B. Howieson, and B. Jacobsen, "Accounting Students' Feedback on Feedback in Australian Universities: They're Less Than Impressed," *Account. Educ.*, vol. 22, no. 5, 2013.

[86] K. Watty, S. Sugahara, N. Abayadeera, and L. Perera, "Developing a Global Model of Accounting Education and Examining IES Compliance in Australia, Japan, and Sri Lanka," *Account. Educ.*, vol. 22, no. 5, 2013.

[87] S. Abhayawansa, I. Tempone, and S. Pillay, "Impact of Entry Mode on Students' Approaches to Learning: A Study of Accounting Students," *Account. Educ.*, vol. 21, no. 4, 2012.

[88] L. M. Tan and F. Laswad, "Understanding students' choice of academic majors: A longitudinal analysis," *Account. Educ.*, vol. 18, no. 3, 2009.

[89] R. J. Lister, "A Role for the compulsory study of literature in accounting education," *Account. Educ.*, vol. 19, no. 4, 2010.

[90] J. van der Laan Smith and R. M. Spindle, "The impact of group formation in a cooperative learning environment," *J. Account. Educ.*, vol. 25, no. 4, 2007.

[91] A. M. Barañano, *Métodos e técnicas de investigação em gestão: manual de apoio à realização de trabalhos de investigação*. 2004.

[92] D. Tranfield, D. Denyer, and P. Smart, "Towards a methodology for developing evidence-informed management knowledge by means of systematic review *," Br. J. Manag., vol. 14, pp. 207–222, 2003.

[93] R. M. S. Wilson, "Editorial," Account. Educ., vol. 1, no. 1, pp. 1–2, 1992.

[94] S. A. Coetzee, K. Leith, and A. Schmulian, "Accounting students access to social media related resources and the risk of tacit social exclusion," Account. Educ., vol. 28, no. 5, pp. 465–483, 2019.

[95] A. Sangster, "You Cannot Judge a Book by Its Cover: The Problems with Journal Rankings," *Account. Educ.*, vol. 24, no. 3, SI, pp. 175–186, 2015.

[96] S. Moya, D. Prior, and G. Rodríguez-Pérez, "Performance-based Incentives and the Behavior of Accounting Academics: Responding to Changes," Account. Educ., vol. 24, no. 3, pp. 208–232, 2015.

[97] R. B. Dull, L. L. F. Schleifer, and J. J. McMillan, "Achievement Goal Theory: The Relationship of Accounting Students' Goal Orientations with Self-efficacy, Anxiety, and Achievement," Account. Educ., vol. 24, no. 2, pp. 152–174, 2015.

[98] P. Everaert, E. Opdecam, and S. Maussen, "The relationship between motivation, learning approaches, academic performance and time spent," Account. Educ., vol. 26, no. 1, pp. 78–107, 2017.

[99] A. Daly, S. Hoy, M. Hughes, J. Islam, and A. S. Mak, "Using group work to develop intercultural skills in the accounting curriculum in Australia," Account. Educ., vol. 24, no. 1, pp. 27–40, 2015.

[100] U. R. Rackliffe and L. Ragland, "Excel in the accounting curriculum: perceptions from accounting professors," Account. Educ., vol. 25, no. 2, pp. 139–166, 2016.

[101] G. Spraakman, W. O'Grady, D. Askarany, and C. Akroyd, "Employers' Perceptions of Information Technology Competency Requirements for Management Accounting Graduates," Account. Educ., vol. 24, no. 5, pp. 403–422, 2015.

[102] J. Carenys and S. Moya, "Digital game-based learning in accounting and business education," Account. Educ., vol. 25, no. 6, pp. 598–651, 2016.

[103] Y. Levant, M. Coulmont, and R. Sandu, "Business simulation as an active learning activity for developing soft skills," *Account. Educ.*, vol. 25, no. 4, SI, pp. 368–395, 2016.

[104] H. Aldamen, R. Al-Esmail, and J. Hollindale, "Does Lecture Capturing Impact Student Performance and Attendance in an Introductory Accounting Course?," Account. Educ., vol. 24, no. 4, pp. 291–317, 2015.

[105] L. Moore, "Exploring the Role of Symbolic Legitimation in Voluntary Journal List Adoption," *Account. Educ.*, vol. 24, no. 3, SI, pp. 256–273, 2015.

[106] J. Webb and C. Chaffer, "The expectation performance gap in accounting education: a review of generic skills development in UK accounting degrees," *Account. Educ.*, vol. 25, no. 4, SI, pp. 349–367, 2016.

[107] N. McGuigan, "The Impact of Journal Rankings on Australasian Accounting Education Scholarship – A Personal View," Account. Educ., vol. 24, no. 3, 2015.

[108] S. Hussain, L. Liu, Y. Wang, and L. Zuo, "Journal Rankings, Collaborative Research and Publication Strategies: Evidence from China," Account. Educ., vol. 24, no. 3, pp. 233–255, 2015.

[109] P. Marriott, S. M. Tan, and N. Marriott, "Experiential Learning – A Case Study of the Use of Computerised Stock Market Trading Simulation in Finance Education," Account. Educ., vol. 24, no. 6, pp. 480–497, 2015.

[110] K. Barac, "Helping Disadvantaged Students: Findings from the Thuthuka Programme," Account. Educ., vol. 24, no. 2, 2015.

[111] L. Wen, Q. Hao, and D. Bu, "Understanding the Intentions of Accounting Students in China to Pursue Certified Public Accountant Designation," Account. Educ., vol. 24, no. 4, pp. 341–359, 2015.

[112] P. Ellington, "The impediments to the change to UK university accounting education, a comparison to the USA pathways commission," Account. Educ., vol. 26, no. 5–6, pp. 576–598, 2017.

[113] H. Lindsay, "More than 'continuing professional development': a proposed new learning framework for professional accountants," Account. Educ., vol. 25, no. 1, pp. 1–13, 2016.

[114] R. A. Cameron and C. O'Leary, "Improving Ethical Attitudes or Simply Teaching Ethical Codes? The Reality of Accounting Ethics Education," Account. Educ., vol. 24, no. 4, pp. 275–290, Jul. 2015.

[115] U. Ramachandran Rackliffe and L. Ragland, "Excel in the accounting curriculum: perceptions from accounting professors," Account. Educ., vol. 25, no. 2, pp. 139–166, 2016.

[116] J. Carenys, S. Moya, and J. Perramon, "Is it worth it to consider videogames in accounting education? A comparison of a simulation and a videogame in attributes, motivation and learning outcomes," *Rev. Contab.*, 2016.

[117] T. Hopper and A. Powell, "Making sense of research into the organizational and social aspects of management accounting: A review of its underlying

assumptions [1]," J. Manag. Stud., vol. 22, no. 5, pp. 429–465, 1985.

[118] G. Burrell and G. Morgan, "Social paradigms and organizational analysis," *Aldershop, Gower*, 1979.

Chapter

Knowledge and Skills Required in Accounting Education: A Comparative Study

Rim Khemiri

Abstract

Accounting education should continually evolve in order to better prepare future professionals for the ever-changing needs. This study aims to ascertain the knowledge, skills and teaching methods considered to be the most important for the successful practice of Certified Public Accountants (CPA). For this purpose, we conducted a survey of 306 CPA and CPA trainees in Tunisia, focuses on four dimensions: knowledge (19 items), professional skills (22 items), technological skills (18 items), and teaching methods (12 items). Results indicated that there are significant differences among the tow subgroups responses regarding the perceived importance of such knowledge and skills. This research presents what the respondents agreed upon as being the most important in terms of knowledge, skills, and teaching methods for the accounting profession. The findings also revealed that there are a similarities and differences between the perceptions of Tunisian professionals and those of Americans and Chinese professionals.

Keywords: Perceptions, Accounting profession, Accounting education, Knowledge, Skills, Teaching methods

1. Introduction

We are witnessing an unprecedented acceleration of the evolution of the business environment, particularly in terms of globalization, market liberalization and the diffusion of new technologies [1]. This results in a constant pressure on higher education institutions, so that they take into account these new constraints and adapt constantly. Accounting education is no exception to the rule, and it has now become necessary to make it evolve by introducing new goals, new tools and new courses.

This development is all the more urgent since some researchers [2–4] have highlighted two disturbing phenomena in the United States: increasingly fewer students opt for educations in accounting, and it is the least brilliant of them who are now choosing this discipline. We can question the extrapolation of these trends in our case, Tunisia. Developments related to globalization, liberalization of markets and the diffusion of new technologies require expanding both the knowledge and the skills from professional accountants in order to meet the needs of the profession in a changing environment. Several previous studies have examined the question of what should be the knowledge and skills components in accounting education programs [5–7].

This research fits into this context. Through a questionnaire-based survey administered to Tunisian professional accountants, we will seek, first, to highlight the knowledge, skills, and teaching methods seen as important for professional accountants and, secondly, we will conduct a comparative study regarding the knowledge and skills perceived as necessary by professional accountants practicing in the United States, China, and Tunisia. Thus, to adapt to the environmental changes mentioned above, accounting education must evolve in order to prepare future professionals for these new requirements. Hence the interest of our research questions: What kind of knowledge, skills and teaching methods are seen as important for professional accountants? And secondly, do the needs of Tunisian accountants professionals match to those of Americans and Chinese's professionals?

The remainder of the paper is organized as follows. The Section 2 presents the study background and reviews the relevant literature. The third section describes the research methodology. Perceptions of the Tunisian professional accountants are described and discussed in Section 4. Finally, we conclude in Section 5 with implications for further research and practice.

2. Study background and literature review

In recent decades, considerable changes have occurred in the business environment, as well as in the nature and the role of the accounting profession. These changes have led accounting education to fundamentally call itself into question [1, 2, 8–11]. Indeed, in western countries, several academic studies and professional reports have identified issues related to the accounting curriculum [5–7]. These latter are considered traditional because they are focused on the training of students to prepare for professional qualifying exams, to the detriment of teaching a broader base of knowledge and professional skills [12–17]. These significant criticisms from the accounting profession, as well as the rapid evolution of technologies [1], economic globalization, and increasing competition in the business world have led teachers in the accounting field to undertake a reform of accounting education, both in the United States and in other countries [18–22]. Thus, in the American context, since 1986 and in order to cope with these changes, the major accounting firms (the "Big Four") created a dedicated commission to study the correlation between accounting education programs and the requirements of the accounting profession resulting from new economic conditions. Due to perceived deficiencies in accounting education, a great number of studies have been conducted, seeking to improve it. Several studies were conducted in the United States, including the report prepared by the Bedford Committee [12] promoting the reform of accounting education in the United States. Later, one report focused on the prospects of international accounting firms and education [23] and, in 1990, the Accounting Education Change Commission (AECC) published a report entitled: *Objectives of Education for Accountants*, stating that the main objective of accounting education is to prepare students to become professional accountants, instead of being professional accountants when they enter the profession [24]. In 1992 the AECC finally recognized the existence of a mismatch between the desired profile of the professional accountant and the qualities offered by accounting education programs. Furthermore, in its report on the future of the profession, the American Institute of Certified Public Accountants (AICPA) called for a change in the accounting curriculum in order to meet the requirements of the accounting profession [25]. For example, these different studies have demonstrated the need to extend the accounting curriculum towards a general accounting education, rather than focusing on traditional training that is overly focused on preparing students for

professional qualification exams [9, 13]. Indeed, in higher education institutions in many countries, most accounting programs have been built too narrowly, with limited knowledge and a lack of skills needed to perform the accounting profession [2, 12, 24, 26, 27].

In their report entitled *Accounting Education: Charting the Course through a Perilous Future*, the same view is shared by Albrecht and Sack [2]. These authors have reached the conclusion that accounting education should change if it is to be relevant and add value to the students and the community. Some educators have heard these warnings and have made significant changes to their programs and curricula. However, in general, the changes undertaken in accounting education have not been expansive enough or were too superficial. A change is all the more urgent since Albrecht and Sack [2] found a decrease in the number of students enrolled in accounting. They also noted that both accounting practitioners and teachers have made alarming statements about students enrolled in accounting, saying that students completing their studies in accounting would not be real specialists in accounting. These are serious problems and we believe that the criticisms are well-founded. Not to mention the threats resulting from market changes and the fact that some factors are not controlled. In addition, Albrecht and Sack argue that the current accounting education should focus on teaching professional skills and greatly expanding the knowledge base. In their report, Albrecht and Sack list a set of knowledge, professional skills, technological skills, and teaching methods, and study the perceived importance of American practitioners and teachers regarding the components of this list. They found that there is a gap in the perception of the importance as well as at the level of the ranking of the knowledge, skills and methods. Teachers are following in the path of the practitioners in recognizing the importance of teaching a number of skills and extra-accounting knowledge [2]. The authors essentially recommend reconsidering the content of programs, focusing on the development of skills at the expense of the excessive accumulation of knowledge, and changing the pedagogy.

Later, in 2002, Francisco and Kelly proposed a continuation of Albrecht and Sack's work, particularly in the area of skills development. To do this, students were asked to assess different professional skills in order to identify those that were the most important for their future career. They identified differences in the perceived importance of these skills between students enrolled in accounting education and those registered in other disciplines. Although there are some variations in the perceptions of students with practitioners and teachers, all stakeholders nevertheless agreed on the need for an immediate and thorough reform in accounting education [2, 28, 29]. Since the report by Albrecht and Sack [2], concerns about the curriculum, seemingly unchanged in the post-Enron era, have been renewed. Attempts to fill in the gaps have not achieved a significant change, and accounting education continues to be "limited, focusing strictly on technical accounting" [30]. Several authors have criticized the limited reaction of academics following the accounting scandals, and advocated broadening the base of accounting education by addressing the economic, social, cultural, and political roles of accounting [31–35]. More specifically, Ravenscroft and Williams [31] argue that "there are currently serious omissions in the accounting curriculum which must be rectified, and that accounting students are poorly trained in some critical areas. Almost, a decade later, the Pathways Commission [5] identified a need for a new model of education that is better aligned with the contemporary environment and evolving demands on accounting professionals. It is the integrated competency-based framework developed as part of a research project of Lawson *et al.,* [6], the first report of the Task Force established in 2010 by the Institute of Management ccountants (IMA) and the Management Accounting Section (MAS) of the American Accounting Association,

to address certain issues of accounting education and make curriculum recommendations for all accounting majors.

Although resistance to changes in accounting education seems to be considerable [2, 17, 36], the above studies and reports produced a positive impact on the development of the accounting education in the Chinese context. Indeed, several studies have focused on the context of an emerging country as China [37–39]. In recent years, due to the rapid evolution of economic reforms and the internationalization of Chinese accounting, accounting education underwent considerable changes to adopt western systems [40–42]. However, after more than two decades of reforms, the Chinese system of accounting education is now quite similar to the U.S. model, deemed traditional [43]. It is in this context that Lin *et al.,* [37] estimate that the Chinese accounting profession should now expect a higher level from the students enrolled in accounting who will be the future professionals. For this, the authors have sought the views of students, teachers and accounting practitioners about their perception of the importance of the require knowledge, skills, and pedagogy, and their assessment of whether or not the specified knowledge and skills component have effectively been delivered by the existing accounting curriculum and pedagogy in China. Although there is some variance in the survey responses, they generally agreed on a set of knowledge and skills and methods deemed important for the training of students. The results also reveal a gap between the most important knowledge and skills for the profession and those taught. Thus, it appears that the reform of accounting education in China is not only necessary, but indispensable.

At the international level, the problem of professional accounting education has become increasingly important, which led the International Federation of accountants (IFAC) to conclude that it is imperative to develop a general framework and standards governing accounting education. To do this, the IFAC Education Committee, International Accounting Education Standards Board (IAESB) has developed International Education Standard (IES) aimed at professional accountants. In addition, the International Educational Guideline (IEG) No. 9 of IFAC asserts that "the objective of theoretical education in accounting is to prepare future competent professional accountants (...) it is necessary to offer an education that provides them with knowledge, skills and rules that allow them to continue to enrich their background and adapt to change throughout their active life" [44]. The IAESB sets standards to increase the "competence of the global accountancy profession and contribute to strengthened public interest" [45]. Indeed, the IAESB declares that adopting IES practice will enhance education in the public interest by "contributing to the ability of the accountancy profession to meet the needs of decision makers" [46]. However, the challenge to the IAESB to motivate education practice in its organizational field goes beyond influencing professional bodies and international regulators with an interest in globalized accounting practice. Audiences involved in professional accountancy education also include, for example professional bodies operating in countries at different stages of development, national governments, private training providers, universities, and employers [47].

In conclusion, the experience of the reforms in accounting education in the United States, in China, as well as in other countries is a relevant reference from which we can draw the inspiration to change the accounting education in other contexts. Given the rapid integration of the Tunisian economy in the global markets through its production of high technology products and the globalization of its trade activities, accounting education in Tunisia is similar to that of the western world. It is, as such, also confronted with this new requirement which has the objective of training students in order to meet the challenges arising from the changing business environment. It seems to us that it is time to suggest changes in the accounting

education in order both to broaden the base of knowledge and to develop skills, and change teaching methods. The timing is particularly appropriate since the Tunisian government, after implementing LMD reform (License-Master-Doctorate) [48], is currently putting implementing a new reform of higher education [49].

3. Methodological approach

In light of our research questions and our purposes, we conducted a survey using a questionnaire prepared based on the literature focused on the theme of the accounting profession needs and accounting education, on the IES and, lastly, on the various existing questionnaires on this theme. The first draft was submitted to three phases of pre-testing. Once finalized, the questionnaire was administered to the 615[1] Certified Public Accountants (CPA) enrolled in the Association of CPA of Tunisia, as well as to the 444[2] Certified Public Accountant trainees (CPAt) who passed the national CPA examination and were, at the time, doing their internship.[3]

The survey instrument includes a list of knowledge (19 items), professional, and technological skills (respectively, 22 items and 18 items), as well as teaching methods (12 items). We asked respondents to express their views about their perception of the importance of the required knowledge, skills, and pedagogy on a scale of 1–4 (1 represents not at all important; 4 is very important).

CPA education seems appropriate to our object of research for three reasons. Firstly, in the Tunisian context, CPA education is training that deals with a very broad program, encompassing different subject matter already studied in the master of accounting (level: high school diploma +4 years). Secondly, the Tunisian CPA education leads to a prestigious national examination. Thirdly, success in this exam allows students to become a CPA after the completion of three years of internship.

An initial release of our survey instrument was conducted by e-mail in September 2010. We then presented the questionnaire by hand to the 350 CPA and CPAt who had not yet responded to our email. After four reminders, we received 131 questionnaires from the CPA and 175 questionnaires from the CPAt. Altogether, 306 usable questionnaires were collected and were entered into SPSS. The overall response rate was 37%, including 26% for the CPA and 48% for the CPAt. Statistical tests carried out in this study are descriptive statistics and comparison of means tests.

4. Professional accountants' perceptions

In this part of the study we will present the perceptions of professional accountants. First, we will put forward the differences in perception between the Tunisian CPA and CPAt about the importance of the needs (4.1.). These needs are seen in terms of knowledge, professional and technological skills, and finally, in terms of teaching methods. Then, we will propose a comparison of perceptions in terms of

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[1] The names of Certified Public Accountants as well as their e-mail address were obtained from the membership directory, available on the website of the Association of Certified Public Accountants of Tunisia-OECT (www.oect.org.tn).

[2] The names of Certified Public Accountants trainees and their email address were obtained from a list that we were provided by the Association of CPA of Tunisia.

[3] Having passed the national examination of Certified Public Accountants in the four public institutions that offer this training and are on period of practical experience that should be a minimum of three years.

needs from professional accountants who are in developed, emerging, or developing countries. These countries are the United States, China and Tunisia (4.2.).

4.1 Perceptions about the needs

Tables 1-4 present the descriptive statistics of our survey results. Mean scores and standard deviations for each item of the knowledge, skills and teaching methods are listed in Panel 1, 2, 3, and 4 respectively. The ranking order of the perceived importance of those items (based on their mean scores) is indicated as well. A significance test of means was also carried out based on the one-way ANOVA. This test allowed us to determine if the status of respondents (CPA or CPAt) is statistically significant in the evaluation of each item.

4.1.1 Empirical results

From the first column in **Table 1**, we can notice that, at the aggregate level, the respondents identified tax, auditing/assurance services, business law, financial accounting, managerial accounting, information systems, finance, technology topics, business strategy and electronic commerce as the ten most important knowledge subjects. Analytical/critical thinking, oral communication, foreign language, written communication, professional demeanor, measurement, risk analysis, teamwork, continuous learning and computing technology were identified as the ten most important professional skills (**Table 2**). According to **Table 3**, spreadsheet software, word processing software, world-wide web searching, systems analysis, windows, presentation software, database software, file & directory management, project management and communication software are, in turn, considered by respondents as the ten most important technological skills. Finally, assignments with real companies, team teaching, case analysis, team (group) work and role playing were identified as the five most effective methods for training accounting students in the current business environment in Tunisia (**Table 4**).

In addition, **Table 1** presents the means and the standard deviations for the CPA and CPA trainees. For the knowledge components, it is important to note that both CPAs and CPA trainees recognized tax as the most important knowledge. However, some variations exist in the scores of perceived importance and the ranking among the two groups of respondents. Regarding the top five most important knowledge items, CPA have ranked auditing/assurance services as the second most important knowledge item, although auditing was ranked as the third most important knowledge item by the CPA trainees. Financial accounting is recognized by CPA as the fourth most important knowledge item, but it was ranked the second most important knowledge item by the CPA trainees. In addition, CPA ranked Ethics and social responsibility as the twelfth most important knowledge, but ethics was seen as only the sixteenth most important knowledge item by the CPA trainees. We also note rather significant differences in ranking regarding several knowledge items, such as, for example, Information systems, Finance and Electronic commerce. Mean scores of the two groups of respondents concerning the less important knowledge items varied considerably. However, retail and sales were ranked last in accordance with perceptions of the two groups.

With regard to the three most requested professional skills, CPA and CPA trainees are consistent in the identification of the third most important skill, namely a foreign language. While analytical/critical thinking was ranked by the CPA trainees as being the most important professional skill, it was ranked the fifth professional skill by the CPA. Regarding oral communication, although it is considered to be the most important professional skill by CPA, it is only recognized by

Panel 1: Knowledge	Total population N = 306			Certified Public Accountants N = 131			Certified Public Accountants trainees N = 175			F (P)
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	
Taxes	3.777	.508	1	3.748	.501	1	3.800	.514	1	.780(.378)
Auditing/Assurance services	3.620	.616	2	3.717	.468	2	3.548	.700	3	5.711(.017)*
Financial accounting	3.604	.558	3	3.580	.540	4	3.622	.572	2	.437(.509)
Business law	3.588	.617	4	3.679	.530	3	3.520	.668	4	5.066(.025)*
Managerial accounting	3.477	.633	5	3.549	.584	5	3.422	.663	6	3.021(.083)
Information systems	3.447	.732	6	3.542	.623	6	3.377	.799	8	3.829(.051)
Finance	3.402	.604	7	3.343	.565	8	3.445	.630	5	2.148(.144)
Technology topics	3.385	.880	8	3.351	.822	7	3.411	.923	7	.350(.554)
Business strategy	3.153	.741	9	3.274	.784	9	3.062	.696	9	6.223(.013)*
Electronic commerce	3.009	.932	10	3.190	.912	10	2.874	.926	12	8.864(.003)**
Statistics/Quantitative methods	2.990	.986	11	3.076	.873	13	2.925	1.061	10	1.750(.187)
Organizational behavior/ Human resource management	2.928	.948	12	3.152	.808	11	2.760	1.011	13	13.359(.000)**
Accounting research methods	2.892	.848	13	2.877	.784	14	2.902	.894	11	.065(.799)
Ethics and social responsibility	2.849	.990	14	3.099	.918	12	2.662	1.003	16	15.227(.000)**
Operations/Supply-chain management	2.771	.968	15	2.824	.854	15	2.731	1.046	14	.690(.407)
Global/International business	2.722	.907	16	2.793	.865	16	2.668	.937	15	1.430(.233)
Economics	2.408	.856	17	2.740	.837	17	2.160	.786	18	38.620(.000)**
Marketing	2.343	.870	18	2.557	.833	18	2.182	.864	17	14.480(.000)**
Retail and sales	2.192	.904	19	2.404	.857	19	2.034	.909	19	13.047(.000)**

*Significant at the 5% level.
**Very significant at the 1% level.

Table 1.
Importance ranking of knowledge.

Panel 2: Professional skills	Total population N = 306			Certified Public Accountants N = 131			Certified Public Accountants trainees N = 175			F (P)
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	
Analytical/Critical thinking	3.692	.558	1	3.694	.509	5	3.691	.593	1	.002(.960)
Oral communication	3.673	.582	2	3.786	.429	1	3.588	.662	4	8.866(.003)**
Foreign language	3.653	.576	3	3.732	.493	3	3.594	.626	3	4.378(.037)*
Written communication	3.627	.620	4	3.709	.488	4	3.565	.698	7	4.084(.044)*
Professional demeanor	3.617	.622	5	3.626	.501	6	3.611	.701	2	.041(.840)
Measurement	3.601	.651	6	3.626	.572	7	3.582	.705	6	.327(.568)
Risk analysis	3.578	.674	7	3.618	.561	8	3.548	.747	8	.801(.371)
Teamwork	3.545	.637	8	3.488	.636	15	3.588	.635	5	1.851(.175)
Continuous learning	3.509	.692	9	3.534	.611	13	3.491	.749	9	.287(.593)
Computing technology	3.500	.678	10	3.557	.570	12	3.457	.748	10	1.633(.202)
Interpersonal	3.483	.697	11	3.564	.569	11	3.422	.775	12	3.127(.078)
Entrepreneurship	3.470	.729	12	3.526	.586	14	3.428	.819	11	1.358(.245)
Decision-making	3.408	.728	13	3.458	.659	16	3.371	.776	13	1.058(.304)
Research	3.388	.739	14	3.580	.594	9	3.245	.803	14	16.088(.000)**
Leadership	3.356	.760	15	3.564	.608	10	3.200	.823	15	18.245(.000)**
Negotiation	3.294	2.419	16	3.755	3.515	2	2.948	.866	20	8.544(.004)**
Project-management	3.232	.729	17	3.351	.619	17	3.142	.793	16	6.204(.013)*
Customer orientation	3.169	.779	18	3.213	.723	20	3.137	.818	17	.723(.396)
Resource-management	3.150	.748	19	3.305	.689	19	3.034	.772	18	10.106(.002)**
Change-management	3.039	.800	20	3.129	.778	21	2.971	.812	19	2.949(.087)
Salesmanship	3.003	.892	21	3.335	.760	18	2.754	.904	21	35.394(.000)**

Panel 2: Professional skills	Total population N = 306			Certified Public Accountants N = 131			Certified Public Accountants trainees N = 175			F (P)
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	
Business Decision Modeling	2.846	.833	22	3.084	.702	22	2.668	.880	22	19.763(.000)**

*Significant at the 5% level.
**Very significant at the 1% level.

Table 2.
Importance ranking of professional skills.

Panel 3: Technological skills	Total population N = 306			Certified public accountants N = 131			Certified Public Accountants trainees N = 175			F (P)
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	
Spreadsheet software (e.g. Excel)	3.735	.559	1	3.763	.477	1	3.714	.614	1	.575(.449)
Word processing software (e.g. Word)	3.585	.612	2	3.542	.598	2	3.617	.622	2	1.130(.289)
World-Wide Web searching	3.503	.673	3	3.442	.622	5	3.548	.708	3	1.853(.174)
Systems analysis	3.441	2.878	4	3.519	2.707	4	3.382	3.007	6	.167(.683)
Windows	3.437	.736	5	3.442	.703	6	3.434	.761	4	.010(.921)
Presentation software (e.g. Power Point)	3.392	.726	6	3.412	.642	8	3.377	.784	7	.174(.677)
Database software (e.g. Access)	3.388	.743	7	3.519	.648	3	3.291	.795	8	7.161(.008)**
File & directory management	3.379	.742	8	3.351	.678	10	3.400	.787	5	.324(.570)
Project management	3.303	.827	9	3.412	.711	7	3.222	.897	9	3.963(.047)*
Communication software (e.g. Outlook)	3.261	.766	10	3.381	.717	9	3.171	.790	11	5.728(.017)*
Intra/Extranets	3.225	.859	11	3.282	.777	11	3.182	.916	10	1.005(.317)
Electronic commerce	3.114	.917	12	3.061	.892	14	3.154	.937	12	.772(.380)
Information systems planning & auditing	3.062	.805	13	3.175	.673	13	2.925	.982	15	4.602(.033)*
Technology management & budgeting	3.062	.833	14	3.213	.822	12	2.948	.825	14	7.753(.006)**
Graphics software (e.g. Adobe)	2.957	.924	15	3.000	.841	15	2.925	.982	15	.483(.487)
Other operating systems	2.526	.955	16	2.916	.868	16	2.234	.914	17	43.477(.000)**
HTML programming	2.392	.993	17	2.595	.942	17	2.240	1.005	16	0.871(.002)**
Programming languages	2.303	.913	18	2.427	.804	18	2.211	.980	18	4.231(.041)*

*Significant at the 5% level.
**Very significant at the 1% level.

Table 3.
Importance ranking of technological skills.

Panel 4: Teaching methods	Total population N = 306			Certified Public Accountants N = 131			Certified Public Accountants trainees N = 175			F (P)
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	
Assignments with real companies	3.594	.681	1	3.687	.497	1	3.525	.786	1	4.239(.040)*
Team teaching	3.500	.678	2	3.542	.558	2	3.468	.756	2	.876(.350)
Case analysis	3.460	.632	3	3.519	.573	3	3.417	.671	3	1.952(.163)
Team (group) work	3.392	.735	4	3.458	.659	5	3.342	.785	4	1.842(.176)
Role playing	3.392	.799	5	3.503	.672	4	3.308	.875	6	4.520(.034)*
Technology assignments	3.352	.845	6	3.396	.751	7	3.320	.909	5	.620(.432)
Oral presentations	3.150	.787	7	3.442	.609	6	2.931	.834	9	35.130(.000) **
Lecture	3.127	.764	8	3.328	.625	8	2.977	.823	8	16.633(.000) **
Feedback exercises (e.g. Quizzes)	3.101	.759	9	3.221	.682	11	3.011	.802	7	5.818(.016)*
Reading textbooks	3.039	.808	10	3.259	.697	10	2.874	.848	10	17.941(.000)**
Writing assignments	2.993	.805	11	3.267	.677	9	2.788	.834	11	28.851(.000) **
Videos	2.555	.871	12	2.740	.780	12	2.417	.911	12	10.641(.001)**

*Significant at the 5% level.
**Very significant at the 1% level.

Table 4.
Importance ranking of teaching methods.

CPA trainees as the fourth most important skill. It should be noted that CPAs perceive decision-making as a relatively unimportant professional skill (ranked 16th), lower than it was perceived by CPA trainees (ranked 13th). It is also interesting to note that CPA trainees ranked written communication seventh, a skill which practitioners gave a much higher ranking to (fourth most important skill). Other findings seem quite striking, in fact, while some skills are relatively important for CPA trainees, CPAs considered them much less important, for example, teamwork, learning, and entrepreneurship. Conversely, some skills appear to be important for CPAs but not at all for CPA trainees. The most striking example is the one relating to negotiation. Indeed, the group of CPAs perceives negotiation as the second most important professional skill while CPA trainees relegated it to twentieth (**Table 2**).

Turning now to technological skills, responses displayed in **Table 3** show a convergence of opinion between CPA and CPA trainees in the ranking concerning the two most important technological skills. The two groups of respondents find that mastering spreadsheet software and word processing software are the two most important technological skills respectively. However, differences in rankings between the two groups are numerous. For example, while mastering databases is considered the third most important technological skill by the CPA, CPA trainees ranked it eighth. Similarly, world-wide web searching was ranked the third most important technological skill by CPA trainees, but was considered only the fifth most important by CPA. Other differences in ranking between the two groups may be observed, for example, concerning the use of file & directory management and communications software. However, both CPA and CPA trainees agreed that programming languages is the least important technological skill.

With regard to the most important teaching methods, surprisingly, both CPA and CPA trainees identified assignments with real companies, team teaching, and case analysis as the three most important methods. Similarly, the two groups of respondents agreed on the least important teaching method, namely the use of videos. However, **Table 4** highlights some differences in ranking, particularly with regard to role playing, technology assignments, and oral presentations. Finally, it is important to emphasize the importance given to writing assignments by CPA (ranked 9th), while CPA trainees ranked them eleventh.

4.1.2 Findings discussion

Our survey results reveal that respondents recognize the importance of a series of knowledge, skills and teaching methods for the training of future professional accountants in the changing business environment in Tunisia. In particular, respondents have a consistent perception of the top five most important knowledge items. As shown in **Table 1**, the knowledge items perceived as being important are mainly traditional accounting subjects such as auditing, financial accounting, and managerial accounting, while most of the broader types of knowledge received relatively lower scores, for example, ethics and social responsibility, global business, and economics. This result may suggest that the importance of receiving broader knowledge in the accounting education is not fully recognized by the respondents. We can conclude that at present time, accounting education of CPA in Tunisia has a relatively narrow focus manifested in particular by the concentration on traditional or content-mastery knowledge, while multidisciplinary roles such as management and other areas in social sciences and humanities are not sufficiently addressed.[4]

[4] As **Table 1** shows, most of the broader-type knowledge subjects have received relatively lower scores.

Regarding professional skills, and particularly those ranked highest, it is interesting to note that CPA' averages are higher than those of CPA trainees. The two groups of respondents rank oral communication among the four most important skills. This seems to contradict the stereotypical impression of isolated professional accountants recording accounting documents throughout the day. It appears that the respondents understand the interpersonal nature of the accounting environment. It is not surprising that CPA trainees consider written communication as the seventh most important professional skill while the professionals consider it to be more important. In fact, CPA are more accustomed to writing business reports and audit opinions, and are therefore more likely to consider the importance of such a skill.

At the aggregate level, analytical/critical thinking is one of the three most important professional skills. However, in our context, only the CPA trainees placed it at the forefront. This can be explained by the fact that most CPA trainees of our sample were exposed to situations that require them to think critically.

Mastering foreign languages were unanimously ranked as the third most important professional skill, both for CPA and CPA trainees. This result is not surprising given the current emphasis on globalization. Apparently, the two groups felt that English was the language of business and, therefore, they should master it.

Moreover, CPA trainees gave much more importance to professional demeanor (ranked 2nd) than CPA (ranked 6th). We can explain this result by the fact that, at the beginning of their careers, CPA trainees are more sensitive to ethics and eventually give tremendous respect to their accreditation body.

The ranking of negotiating skill was very high in the CPA sample. Indeed, they regard it as the second most important professional skill because, after many years of practice, they are able to recognize that negotiation plays a major role in their everyday life. Conversely, CPA trainees are still at the level of their internship and haven't faced such situations yet. In the course of their internship, they are assigned tasks that do not require the use of negotiation, for example, bookkeeping and auditing.

The ranking of respondents regarding the five least important skills show less striking diversity than at the level of the five most important skills. Actually, both groups of respondents ranked the following items: customer orientation, resource-management, change-management, salesmanship, and business decision modeling, close together and were unanimous regarding their importance. The results also show that customer orientation is not considered as a very important skill for both CPA trainees and CPA. This seems surprising on the part of the CPA who work in firms that depend on their customers. Therefore, they should take more account of the present and future needs of their customers and should meet their requirements and strive to meet their expectations. Change management was considered more important by trainees than by practitioners. This result is surprising since practitioners have had experience in the real world and should therefore be aware that change is part of life. Despite their young age, CPA trainees are aware that all companies must evolve in order to survive in today's dynamic environment.

The rankings of technological skills highlight the agreement of CPA and CPA trainees regarding the importance given to spreadsheet software and word processing software. Thus, this result shows the importance of the use of spreadsheet software and word processing software in the daily tasks that Tunisian professional accountants are required to carry out, including bookkeeping and the preparation of audit reports. However, it appears that the two groups of respondents do not share the same opinion when it comes to world-wide web searching. CPA trainees give more importance to web searching. This finding could be explained by a shift between two generations. The new generation of Tunisian

professional accountants gives more importance to web searching. They therefore understood the relevance of search engines when it comes to seeking information. While it seems that CPA prefer using more conventional means when it comes to looking for information. HTML programming and programming languages do not appear to be important for the two groups of respondents. We can explain this result by the existence of programming experts who are more likely than professional accountants to carry out programming.

Finally, concerning the teaching methods in accounting education, both groups of respondents have similar views on the importance of the various methods. One notable difference is that practitioners have given greater weight to writing assignments compared to feedback exercises (e.g. Quizzes), while CPA trainees have an opposite point of view. This may be interpreted by the fact that Tunisian CPA trainees should be aware of the importance of the written communication skills that CPA need (ranked 4th).

4.2 Comparative study

After having studied the perceptions of the Tunisian respondents about their needs, we will now offer a comparison of the perceptions of the importance of knowledge, professional skills, technological skills, and teaching methods for professional accountants coming from different economic and cultural environments. **Table 5** shows the ranking of the different components of the knowledge, skills, and teaching methods items. The ranking order is determined by the average score of the perceived importance of each item or component. The Tunisian sample data were collected from our survey. U.S. and Chinese data results from studies conducted by Albrecht and Sack [2] and by Lin *et al.,* [37] respectively (data for accounting practitioners). Some differences in the perceptions of the importance of knowledge, professional and technological skills and teaching methods among Tunisian, Chinese and Americans respondents must be noticed.

According to **Table 5**, the ranking of the first three knowledge items is relatively uniform for both American and Chinese samples, namely financial accounting, taxes, and finance. Gaps exist for other knowledge items. For example, there are considerable differences in the ranking of information systems, business law, ethics, and social responsibility. Indeed, information systems was ranked as the second most important knowledge item by U.S. practitioners [2], but ranked eighth by Chinese respondents [37], and placed sixth by professional accountants in Tunisia. This difference is probably due to the fact that information systems are much less developed in China and Tunisia than in the United States. Thus, the Tunisian respondents could not give the same high ranking for this item as their counterparts in the United States. In addition, business law which was classified by Chinese practitioners as the sixth most important knowledge item and by their American counterparts as the tenth most important one has been ranked by Tunisian practitioners as the fourth most important knowledge item. The reason for this may be due to the importance given by the Tunisian accounting profession to the issues of rights. Thus, business law is, at present, considered a very important component of the accounting education in Tunisia.

Another difference to note concerns ethics and social responsibility, which were ranked as the fifth most important knowledge item by Chinese practitioners, the twelfth most important by U.S. practitioners [2] and the fourteenth most important knowledge item by Tunisian practitioners. Such a difference can be explained by the fact that the accounting profession at the worldwide level has established a major emphasis on ethics and social responsibility in recent years. This happened as a response to public concerns following the Enron and Arthur Andersen case at the

Professional accountants			
	Tunisia: Khemiri, 2012	**China: Lin & al, 2005**	**USA: Albrecht & Sack, 2000**
Panel 1: Knowledge			
Taxes	1	2	3
Auditing/Assurance services	2	7	6
Financial accounting	3	1	1
Business law	4	6	10
Managerial accounting	5	4	7
Information systems	6	8	2
Finance	7	3	3
Technology topics	8	10	8
Business strategy	9	14	5
Electronic commerce	10	13	9
Statistics/Quantitative methods	11	17	14
Organizational behavior/Human resource management	12	16	17
Accounting research methods	13	—	15
Ethics and social responsibility	14	5	12
Operations/Supply-chain management	15	18	16
Global/International business	16	12	11
Economics	17	9/11[1]	13
Marketing	18	15	18
Retail and sales	19	19	—
Panel 2: Professional skills			
Analytical/Critical thinking	1	4	2
Oral communication	2	8	3
Foreign language	3	9	22
Written communication	4	3	1
Professional demeanor	5	1	10
Measurement	6	—	20
Risk analysis	7	—	13
Teamwork	8	6	5
Continuous learning	9	—	9
Computing technology	10	2	4
Interpersonal	11	7	7
Entrepreneurship	12	14	19
Decision-making	13	5	6
Research	14	1	18
Leadership	15	10	8
Negotiation	16	15	15
Project-management	17	11	10

Professional accountants			
	Tunisia: Khemiri, 2012	**China: Lin & al, 2005**	**USA: Albrecht & Sack, 2000**
Customer orientation	18	16	16
Resource-management	19	12	17
Change-management	20	17	14
Salesmanship	21	18	21
Business Decision Modeling	22	13	12
Panel 3: Technological skills			
Spreadsheet software (e.g. Excel)	1	—	1
Word processing software (e.g. Word)	2	—	3
World-Wide Web searching	3	—	4
Systems analysis	4	—	15
Windows	5	—	2
Presentation software (e.g. Power Point)	6	—	6
Database software (e.g. Access)	7	—	8
File & directory management	8	—	6
Project management	9	—	11
Communication software (e.g. Outlook)	10	—	10
Intra/Extranets	11	—	16
Electronic commerce	12	—	12
Information systems planning & auditing	13	—	12
Technology management & budgeting	14	—	14
Graphics software (e.g. Adobe)	15	—	19
Other operating systems	16	—	20
HTML programming	17	—	21
Programming languages	18	—	22
Panel 4: Teaching methods			
Assignments with real companies	1	3	2
Team teaching	2	—	8
Case analysis	3	2	5
Team (group) work	4	—	3
Role playing	5	7	7
Technology assignments	6	4	1
Oral presentations	7	—	6
Lecture	8	—	12
Feedback exercises (e.g. Quizzes)	9	—	10
Reading textbooks	10	—	11

	Professional accountants		
	Tunisia: Khemiri, 2012	**China: Lin & al, 2005**	**USA: Albrecht & Sack, 2000**
Writing assignments	11	5	4
Videos	12	—	9

[1]*According to the study of Lin* et al. *[37], item economy was split in microeconomics (ranked 9th) and macroeconomics (11th).*

Table 5.
Importance ranking of Tunisian, Chinese and American accounting practitioners.

beginning of 2001. So, it seems that Chinese have recognized the ethics and social responsibility as a very important knowledge item for accounting education. Obviously, Tunisian practitioners are still not aware of the importance of such knowledge in accounting education.

In addition, as shown in panel 2 of **Table 5**, there are considerable differences in the perceived importance of the professional skills necessary for professional accountants in the Tunisian, Chinese and American contexts. The major items which received scores of varied importance by Tunisian, Chinese and Americans respondents are especially analytical/critical thinking, professional demeanor, foreign language, computing technology, communications (written and oral), decision-making, change-management and research. Thus, while Chinese respondents gave information technology a higher rank than American respondents did, Tunisian respondents, for their part, assigned it a rank lower than that of the Americans and Chinese (ranked 10th). This ranking by the Tunisian professionals seems surprising because computerization is now gaining ground in Tunisia. Indeed, the level of computer culture is high in Tunisia and such skills may have been taken for granted by Tunisian professional accountants. Similarly, professional demeanor is ranked by Tunisian respondents as the fifth most important skill, while Chinese practitioners put it in first place and American practitioners only in tenth place [2]. The difference may be due to the different business environments of the three countries. Further, as the accounting profession is less mature in Tunisia, Tunisian respondents may feel that it is important to develop professional demeanor to improve the social status and reputation of the Tunisian accounting professionals.

Foreign languages are ranked ninth by the Chinese, while it was perceived as the least important professional skill by American practitioners. However, the Tunisian practitioners put it in the third place. Since the gradual integration of the Tunisian economy in the world market, especially after the entry of Tunisia in the World Trade Organization (WTO) in 1995, mastering foreign languages has become a very important professional skill and one that is useful for Tunisian professional accountants, allowing them to work for foreign clients or Tunisian companies which possess subsidiaries abroad or working in cooperation with foreign companies. Regarding the American CPAs' ranking of foreign languages, it is possible that respondents consider the English language to be the universal language of business and that communications around the world are generally made in English. Therefore, they minimize the value of foreign languages by considering them to be useless.

Critical thinking, oral, as well as written communications are considered in the Albrecht and Sack [2] study to be the three most important professional skills in the eyes of American professionals. This view is shared by Tunisian professionals. Chinese respondents, however, give these skills relatively low ranking. This finding

may reflect the fact that accounting practices and transactions are quite complicated, so Tunisian professionals employ the analytical and critical thinking and professional judgment in their practice. In addition, the high rankings given to oral and written communication by Tunisian respondents seem surprising. Indeed, this result contradicts the influence of the eastern culture in which individuals are supposed to be humble and must strictly obey the orders or instructions of their superiors. In such a cultural context, bidirectional communication is generally not encouraged and the value of communications skills could be underestimated. These skills are crucial for accountants in a changing and dynamic business world and they should take a greater role in accounting education in Tunisia.

Regarding technological skills, only the U.S. and Tunisian professionals have expressed themselves about their perception of the level of importance of such skills. Moreover, it is interesting to note the convergence of the two groups of respondents particularly at the level of the ranking of the most important technological skills and the least important. On the one hand, U.S. and Tunisian practitioners agree on the importance of spreadsheet software, word processing software and world-wide web searching for the accounting profession. It seems that these three technological skills are widely used in the daily tasks of the practitioners. In addition, this consistency in the perceptions of importance of the two groups of respondents may reflect the level of computerization among the Tunisian accounting professionals who seem seduced by its multiple benefits: speed, reliability, traceability, inventory management, paper saving and teleconsultation of documents. On the other hand, the two groups of respondents pointed the same technological skills which appear to them to be least important for accounting practice. This is the case, for example, for HTML programming and programming languages. It seems that these skills are considered overly technical specialties for professional accountants and that it is more appropriate to employ a specialist when necessary.

Lastly, the perceived level of importance of teaching methods by U.S., Chinese and Tunisian professionals reveals some differences. While Tunisian respondents rank team teaching second, American respondents rank it eighth. In addition, technology assignments are considered by American practitioners as the most important teaching method. Chinese practitioners rank it fourth, while Tunisian practitioners rank it only sixth. This result shows that the use of technology is part of the American educational landscape. It helps to explain the importance given by American professionals, on the one hand, to technology as being one of the ten most important knowledge items and, on the other hand, to computing technology as being the fourth most important professional skill. We can also notice that Tunisian professionals have not been made sensitive to the completion of technological skills; this could be due to the fact that technological tools have not yet made their appearance in the accounting education of CPA. Similarly, respondents do not agree on the importance of writing assignments. While American professionals believe that writing assignments are the fourth most important pedagogical method, Chinese and Tunisian respondents ranked them seventh and eleventh respectively. Such a result confirms the importance given to written communications by American practitioners (ranked the most important skill), which is not the case for other respondents. So, it seems that writing assignments help to initiate the future professionals in the writing of numerous reports that they will be required to carry out, for example, audit reports.

However, the three groups of respondents have similar views in terms of the perceived importance of assignments with real companies, team (group) work, and role playing. These different methods enable developing certain skills required for the accounting practice. For example, assignments with real companies can develop the critical and analytical mind of students. Team teaching could teach students

leadership and importance of collaboration. And role-playing introduces students to negotiation. The use of textbooks doesn't seem to be an important teaching method for both American and Tunisian professional accountants. Indeed, the use of textbooks seems to be abandoned in favor of other methods that extend the scope of knowledge and also have the possibility of updating.

5. Conclusion

Major changes in the environment of affairs throughout these last decades have greatly impacted the accounting profession. The development of globalization and technology has resulted in new requirements for professional accountants. For example, these needs are reflected in the emergence of new missions with high added value, whose demand is ever increasing, such as consulting and opinion services. To carry out these new missions, professional accountants must get an academic education that enables them to develop new competencies (knowledge and skills). The identification of these competencies has been the subject of both academic [6, 11, 28, 37, 38] and professional studies [5, 12, 25, 50].

All the studies converge and identified a set of knowledge and skills as well as technical, personal [51], and in the field of Information and Communication Technology (ICT). Technology forces today are significantly changing many professions, including the accounting profession. Hood [52] reports the result of interviews with thought leaders throughout the accounting profession, noting their three "biggest nightmares:" (1) technology-induced changes that devalue longstanding core services of the profession, (2) finding new employees with the right mix of skills and retraining current employees who need new skills, and (3) keeping up with the pace of technology change [52]. Further evidence of the impact of technology forces on the accounting profession may be seen in significant offshoring of tasks (to lower costs) and increasing automation of accounting/finance jobs. The result is an increasing skills gap in accounting/finance [1]. However, if the Anglo-Saxon countries, including the United States, were the first to respond to this new economic situation in adopting educational systems capable of providing the future professional knowledge and skills mentioned above, Tunisia, for its part, has set up a higher education system on the License-Master-Doctorate model, without so far, providing a specific accounting educational path for CPA. Can we say that the current system of CPA education in Tunisia is adapted to the needs of the accounting profession?

We conducted a survey on Tunisian CPA and CPA trainees. The results revealed a range of knowledge, skills and teaching methods considered to be the most important. The results also highlight similarities in the perception of knowledge and skills required by professional accountants, whether they are Tunisians, Chinese or Americans. Differences of perception are probably due to the differences in terms of economic and technological development, as well as social and cultural influences that differ from one country to another. Thus, this research has helped to form two convictions. The first one is that we must continue to think about the pedagogy to adopt in the context of accounting education, as well as the manner in which the knowledge is transmitted [11, 51]. The second is that academic accounting education curriculum plays a crucial role to meet the needs of the profession and influences the development of the profession.

In conclusion, this work cannot claim to have responded to all issues related to the problems and challenges facing accounting education, even less to have found the solutions. One of the main objectives of this study was to try to put the problem in its context and to propose a model for analyzing the situation. Academics in the

field of accounting face the challenge of repositioning their discipline in a position of excellence. Indeed, the accounting discipline should be organized in order to benefit from the experience gained particularly over the last decades, to evolve and adapt to new challenges and new expectations of the accounting profession. This can be accomplished only if the academic world agrees to abandon its conformity and its commitment to traditional teaching methods. It is obvious that in the current state, higher education institutions have no choice than to change their methods. The costs associated with the implementation of these changes are much lower than the costs that would be generated by a possible lack of action.

Conflict of interest

"The author declares no conflict of interest."

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References

[1] Pincus K V, Stout D E, Sorensen J E, Stocks K D, Lawson R A. Forces for change in higher education and implications for the accounting academy. Journal of Accounting Education. 2017; 40: 1-18. DOI: 10.1016/j.jaccedu.2017.06.001

[2] Albrecht W S, and Sack R J. Accounting education: charting the course through a perilous future. Accounting Education, American Accounting Association; 2000; Sarasota, FL. Series 16.

[3] Sanders B, and Romeo L B. The supply of accounting graduates and the demand for pubic accounting recruits. 2000, New York: American Institute of Certified Public Accountants.

[4] Sanders B, Goldfarb S and Romeo LB. The Supply of Accounting Graduates and the Demand for Public Accounting Recruits–200J. For Academic Year 1999-2000; 2001; New York: American Institute of Certified Public Accountants.

[5] Pathways Commission. Charting a National Strategy for the Next Generation of Accountants. [Internet]. 2012. Available at: http://commons.aaahq.org/files/0b14318188/Pathways_Commission_Final_Report_Complete.pdf

[6] Lawson R A, Blocher E J, Brewer P C, Cokins G, Sorensen J E, Stout D E, Sundem G L, Wolcott S, and Wouters M J F. Focusing accounting curricula on students' long-run careers: Recommendations for an integrated competency-based framework for accounting education. Issues in Accounting Education. 2014; 29 (2): 295-317. DOI: 10.2139/ssrn.2342306.

[7] Lawson R A, Blocher E J, Brewer P C, Morris J T, Stocks K D, Sorensen J E, Stout D., and Wouters M J F. Thoughts on competency integration in accounting education. Issues in Accounting Education. 2015; 30 (3): 149-171. DOI: 10.2308/iace-51021

[8] Sundem G L, and Williams D Z. Changes in accounting education: preparing for the twenty-first century. Accounting Education: An International Journal. 1992;1(1), 55-61. DOI.org/10.1080/09639289200000006

[9] Williams D Z. Reforming accounting education. Journal of Accountancy. 1993, 176(2): 76-82.

[10] Nelson IT, Bailey J A, and Nelson A T. Changing accounting education with purpose: market-based strategic planning for departments of accounting. Issues in Accounting Education. 1998; 13(2): 301-326.

[11] Khemiri R. L'enseignement supérieur en comptabilité : enjeux et perspectives pour la profession comptable, cas de la Tunisie [thesis]. Université de Toulouse I Capitole, France; 2012.

[12] American Accounting Association. Future accounting education: preparing for the expanding profession. Issues in Accounting Education. 1986; 1(1): 168-195.

[13] Sundem G L. Changes in accounting education in the United States: the impact of the accounting education change commission. International Handbook of Accounting Education and Certification. ed. A. ANYANENTOW. NY: Pergamon Press; 1992.

[14] Kimmel P. A framework for incorporating critical thinking into accounting education. Journal of Accounting Education. 1995; 13: 299-318. DOI: 10.1016/0748-5751(95)00012-B

[15] Cummings B, Bennett R E and Normand C J. Meeting the challenge: the

university accounting program corporate American needs. Management Accounting Quarterly. 2001; (Winter): 4-13.

[16] Barsky N P, Catanach A H, and Kozlowski B M. Creating strategic responses to critical risks facing accounting education. Issues in Accounting Education. 2003; 18(4): 445-459. DOI: 10.2308/iace.2003.18.4.445

[17] Gibbin A L. The crisis in accounting education. Journal of Accountancy. 2002; 193(4), 81-86.

[18] Montano J A, Anes J A D, Hassall T and Joyce J. Vocational skills in the accounting professional profile: The chartered institute of management accountants (CIMA) employer's opinion. Accounting Education: An International Journal. 2001; 10(3): 299-313. DOI: 10.1080/09639280210122339

[19] Burnett S. The future of accounting education: a regional perspective. Journal of Education for Business. 2003; 78(3): 129-136. DOI: 10.1080/08832320309599709

[20] Forristal T. CAP Forum: The future of accounting education: the response of charted accountants. Canadian Accounting Perspectives. 2002; 1(1): 80-88.

[21] Howieson B. Accounting practice in the new millennium: is accounting education ready to meet the challenge. The British Accounting Review. 2003; 35(2): 69-78. Doi:10.1016/S0890-8389(03)00004-0

[22] Taylor V A and Rudnick M. Accounting education: designing a curriculum for the 21st century. Journal of American Academy of Business. 2005; 6(2): 321-323.

[23] Arthur Andersen and Co. Perspectives on education: capabilities for success in the accounting profession. New York; 1989: Arthur Anderson and Co. et *al*.

[24] Accounting Education Change Commission. Objectives of education for accountants: position statement number one. Issues in Accounting Education. 1990; 5(2): 307-312.

[25] American Institute of Certified Public Accountant. The CPA vision project, 2011 and beyond. 1998; AICPA web site.

[26] Nelson A T. The future for accounting education: A view from rocking chair. Journal of Accounting Education. 1996; 14(2): 245-254. DOI: 10.1016/0748-5751(96)00014-0

[27] Aly I M and Islam M. Audit of accounting program on oral communication apprehension: a comparative study among accounting students. Managerial Auditing Journal. 2003; 18(9): 751-760. DOI: 10.1108/02686900310500514

[28] Francisco B, and Kelly A. Beyond Albrecht and Sack: a comparison of accounting professionals and college students [Internet]. 2003. Retrieved June 27, Available from http://www.aicpa.org/download/career/edu/Beyond_Albrecht_Sack.pdf, 2002.

[29] Russell K and Smith C. Accounting education's role in corporate malfeasance: its time for a new curriculum. Strategic Finance. 2003; 85(6): 46-52.

[30] Boyce G. Critical accounting education: teaching and learning outside the circle. Critical Perspectives on Accounting. 2004; 15(4-5): 565-586. DOI: 10.1016/S1045-2354(03)00047-9

[31] Ravenscroft S P and Williams P. Accounting education in the U.S. post-Enron. Accounting Education: An International Journal. 2004; 13(1): 7-23. DOI: 10.1080/0963928042000310760

[32] Cooper D J, Everett J and Neu D. Financial scandals, accounting change and the role of accounting academics: a perspective from North America. European Accounting Review. 2005; 14 (2): 373-382. DOI: 10.1080/09638180500124905

[33] Diamond M. Accounting education, research and practice: after Enron, where do we go? European Accounting Review. 2005; 14(2): 353-362. DOI: 10.1080/09638180500124855

[34] Ferguson J, Collison D, Power D, and Stevenson L. What are recommended accounting textbooks teaching students about corporate stakeholders? The British Accounting Review. 2005; 37(1): 23-46. DOI: 10.1016/j.bar.2004.08.002

[35] Ferguson J, Collison D, Power D, and Stevenson L. Accounting textbooks: exploring the production of a cultural and political artifact. Accounting Education: An International Journal. 2006; 15(3): 243-260. DOI: 10.1080/09639280600850679

[36] Fedoryshyn M W, and Tyson T N. The impact of practitioner presentations on student attitudes about accounting. Journal of Education for Business. 2003; 78(5): 273-284. DOI: 10.1080/08832320309598614

[37] Lin Z J, Xiong X, and Liu M. Knowledge base and skill development in accounting education: Evidence from China. Journal of Accounting Education. 2005; 23(3): 149-169. DOI: 10.1016/j.jaccedu.2005.06.003

[38] Lin Z J. A factor analysis on knowledge and skill components of accounting education: Chinese case. Advances in Accounting. 2008; 24(1): 110-118. DOI: 10.1016/j.adiac.2008.05.009

[39] Chen TTY. A comparative study of what accounting employers in the United States and Hong Kong expect: Implications for curriculum and pedagogical design. Global Perspectives on Accounting Education. 2013; 10: 121-132.

[40] Tang Y. The recent accounting development and internationalization of accounting education in China. Issues in Accounting Education. 1997; 12(2): 219-228. ISBN: 1558-7983

[41] Chan L. Accounting education and economic reform in the people's Republic of China. International Studies of Management and Organization. 1999; 29: 37-55. DOI: 10.1080/00208825.1999.11656770

[42] Rahaman A S. Accounting and socio-economic development paradigms. Journal of American Academy of Business. 2005; 6(2): 217-222.

[43] Wu T, and Tong Y. Issues and challenges of accounting education in China: practitioners and academic perspectives. Journal of American Academy of Business. 2004; 4(1/2): 208-219.

[44] International Federation of Accountants. International education Guideline N° 9: Prequalification education, assessment of professional competence and experience requirements of professional accountants. Education Committee; 1991.

[45] International Accounting Education Standards Board. IAESB factsheet [Internet]. 2013. Available from: https://www.ifac.org/sites/default/files/uploads/IAESB/IAESB.pdf.Accessed April 2013.

[46] International Accounting Education Standards Board. Handbook of international education pronouncements. ed.2010. New York: IFAC ; 2010a.

[47] Crawford L, Helliarc C, Monka E, Veneziani M. International Accounting Education Standards Board: Organisational legitimacy within the field of professionalaccountancy education. Accounting Forum. 2014; 38: 67-89. DOI: 10.1016/j.accfor.2013.09.001

[48] Khemiri R, Ben Chahida M. Introduction of Information and Communication Technologies Teaching in Accounting Education Following the LMD Reform in Tunisia: Toward a Market Orientation. The Journal of African Research in Business & Technology. 2010; V2010: 1-14. DOI: 10.5171/2010.206493

[49] Commission Nationale de la Réforme de l'Enseignement Supérieur: CNR. Plan stratégique de la réforme de l'enseignement supérieur et de la recherche scientifique 2015 – 2025. MESRS; 2015.

[50] American Institute of Certified Public Accountant. AICPA Core Competency Framework & Educational Competency Assessment Website [Internet]. 2015. Available from: <http://www.aicpa.org/interestareas/accountingeducation/resources/pages/corecompetency.aspx> Accessed 02.15.

[51] Chabrak H, and Craig R. Student imaginings, cognitive dissonance and critical thinking. Critical Perspectives on Accounting. 2013 ; 24(2): 91-104. DOI: 10.1016/j.cpa.2011.07.008

[52] Hood D. Losing sleep: Leaders of the profession on its biggest nightmares. Accounting Today. 2015; 29(10).