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Approaches on technological innovation and the accounting profession: A Systematic Review

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Master in Business Administration

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March, 2021



BUSINESS
SCHOOL

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I imagine that the acknowledgements written since 2020 have changed quite a bit when compared to the previous ones, after all, it has been for most of us, a tough year. COVID-19 affected us all and modified the way we perceive the world around us. In the last year I have lost family and friends, I fell into a depressive state of mind that affected not only myself but those around me. It was really difficult for me to comeback from the place 2020 pushed me into, actually, I truly believe I still struggle to become myself again and to be able to enjoy more than a few happy moments each day.

I never thought It would be such a challenge for me to be able to complete the step of my academic live that this dissertation represents. A part of this dissertation was made by the ones that helped me throughout the difficult times we all went through.

I would like to dedicate this dissertation to my Grandmother, Maria Amélia who passed away last year.

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Resumo

Enquadramento: o desenvolvimento das tecnologias de informação tem impactado o mundo significativamente, reduzindo distâncias entre países erodindo as barreiras entre mercados, criando uma realidade global. A contabilidade tem sofrido os efeitos da evolução tecnológica que molda o sector através da criação de novas práticas, da alteração das exigências dos mercados e do desenvolvimento de novos sistemas.

Objectivos: diminuir a lacuna de conhecimento sobre a relação entre a contabilidade e a tecnologia, identificando os padrões da mesma e providenciando informação relevante sobre como abordar o tópico de forma mais eficiente, permitindo que indivíduos e instituições se preparem da melhor forma para as mudanças que se sentem hoje e que se sentirão futuro.

Metodologia: uma revisão sistemática da literatura foi elaborada, executando nos artigos seleccionados uma análise de dados baseada em quatro variáveis. Quatro critérios foram utilizados para a pesquisa dos artigos. Um processo de selecção foi levado a cabo através da análise do título, resumo e texto integral.

Resultados: a revisão da literatura aponta para aspectos específicos da relação entre a contabilidade e a tecnologia, parcialmente suportados numa análise de dados que evidencia uma dispersão geográfica e temporal acentuada bem como uma preferência significativa dos autores pela utilização de métodos qualitativos.

Conclusão: este estudo demonstra que a relação entre a tecnologia e a contabilidade é um assunto actual e relevante, preferencialmente abordado através de análises profundas e especificamente baseado nas tecnologias de informação e as alterações sofridas no sector da contabilidade.

Palavras-Chave:

contabilidade; sistemas de informação; tecnologia de gestão; contabilistas; mudanças profissionais

Abstract

Background: the development of information technology is having a significant impact in the world, reducing the distances between countries and eroding the barriers between markets, creating a global reality. Accounting has been suffering the effects of the evolution of technology that molds the sector through the rise of new practices, the changing demands of the markets and the development of new systems.

Objectives: diminish the knowledge gap on the relationship between technology and accounting, identifying the patterns of such relationship and provide relevant insights on how to approach the topic in a more efficient way, enabling individuals and institutions to better prepare for current and future changes in the sector.

Methods: a systematic literature review was applied with a data analysis based on four variables of the articles included. Four criteria were used for the search. A selection process was applied based on a Title Sift, Abstract Sift and Full-Text Sift.

Results: the literature review points out specific aspects from the relationship between accounting and technology partially supported by the data analysis that shows a great geographical and temporal dispersion and a significant preference of authors for the use of in in-depth qualitative studies.

Conclusions: this research shows that the relationship between technology and accounting is a “hot topic”, preferentially approached through in-depth studies, and specifically based on IT and the changes caused in the accounting sector.

Keywords

accounting; Information Systems; accounting technology; accounting roles; methodology change

Jel classification

M1 - Business Administration; M41 – Accounting; M4 – Accounting and Auditing; M15 - IT Management

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List of Acronyms

AI	Artificial Intelligence
AIMD	Artificial Intelligence Measurement of Disclosure
AIS	Accounting Information Systems
BOB	Best of Breed
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
ES	Enterprise Systems
IS	Information Systems
IT	Information Technology
MIS	Management Information Systems
RTA	Real-Time Accounting
SAP	System Applications and Products in Data Processing
SPSS	Statistic Package for Social Sciences
XBRL	Extensible Business Reporting Language

1. Introduction

The business market reality we now live in is quite different from the one of the previous century. New ways of communicating faster and more effectively forced the opening of borders and markets, rapidly developing a global society and economy that produced changes in many sectors of activity, moulding the old ways into modern ones (Duran, 2015; Smith, 2016).

Accounting was no exception to the rule, the dynamic developments in the field of Information Technology (IT) created a fast flow of new technologies which resulted in an alteration of some practices and techniques as accountants struggle to adapt to avoid possible threats and conquer uncertain opportunities (Elliott, 1998; Rîndaşu, 2017). For quite some time now, researchers in accounting have looked into the phenomenon unleashed by technology that is impacting the profession, the professionals and also the institutions (Chiu et al., 2019). With global markets going through an evolution process, it makes sense for accounting to do the same (Smith, 2016), after all, we are already witnessing this process unfolding since the 90`s, when accountants started being pushed into new directions (Rezarta, 2010).

Technology evolved accounting techniques and practices, changed the roles and positions of accountants in modern firms and triggered a response process from academic institutions in order to better prepare the accountants of tomorrow (Andiola et al., 2020a; Borisova & Bekhteneva, 2015; Nicolae, 2019; Rezarta, 2010). Specifically IT, seems to be perceived by some authors as a cornerstone for the optimal accounting curriculum (Ainsworth, 2001), and because of that, academic institutions should be able to adjust their graduates' profiles to a new reality (Odia, 2019).

However a pressing matter, there seems to be little contributes in literature on how to access the ever increasing proximity of accounting and technology. It is by exploring the depth of the relationship between technology and accounting and also the ways that have been used by authors to tackle this topic, that this research aims to develop a clear understanding of the nature of such connection and provide relevant insights on how the problem should be approached and handled.

In this research we aim to look into the work that has been done on accounting directed technology and the ways in which such researches have been conducted through a

systematic review of the contents produced on the matter and statistical analysis of specific variables defined.

This work contributes to literature as it tackles a popular topic in recent years (Chiu et al., 2019), absorbing the relevant content produced to create well informed and necessary conclusions about the characteristics of the relationship between accounting and technology. More importantly, this research aims to present the way in which one should approach the evolution of accounting to this day, developing relevant insights about the skillsets of accounting professionals now and the ones they should acquire in the future.

The evolution of technology is not slowing down, and new applications aimed for accounting will continue to be developed. It is therefore important that individuals and institutions are well aware of the ways in which they should approach this issue so that accountants may look to innovation as an opportunity and not a threat (Moll & Yigitbasioglu, 2019).

This dissertation is a systematic literature review organized as follows:

- Firstly, it was conducted a broad selection of articles that were reviewed, contributing to a comprehensive analysis of the topics' state of the art. This literature review helped creating a context for the methodology chosen when performing the systematic literature reviewed that followed.
- Concerning the methodology, the articles were searched based on the keywords, subject area, data range and document type, being afterwards selected through a process of three step filtering (Booth et al., 2016).
- The articles that passed through the selection process and that were included in the review were categorized according to four variables that helped to reach the defined objectives.
- Finally, the results of the systematic review were summarized in a conclusion based in the information retrieved from the conducted analysis integrated in the context provided by the initial literature review.

THEORETICAL FRAMEWORK

2. Literature Review

2.1 Where we stand

Since the very beginning of the millennium, researchers in accounting are giving a lot of attention to emerging technologies, highlighting the perceived importance of technology in the accounting profession (Chiu et al., 2019). It is clear that technological advances impacted accounting, which led to a sharp decrease in the expensiveness of information, requiring less effort in capturing it or in creating new opportunities. Thereby accountants have struggled to adapt to the better use of information and knowledge that IT generated, dictating new rules for competitive advantage (Elliott, 1998). The arrival of IT induced friction between traditional accounting and the need to develop faster and more detailed responses to the demands that were also changing, creating new challenges to accounting professionals mainly through the development of Enterprise Resource Planning (ERP) systems, group support systems, knowledge management systems and intelligent decision aids (Sutton, 2000). Recent IT accounting solutions are known to induce social transformations in an organization, creating the need for a rationality that combines accountants, who must acquire new IT knowledge, and management, as IT solutions, which means accountants and management are pressed together (Hyvönen et al., 2008). Considering that accounting has been described as a social institutional practice dependent of external factors, even if organizations maintain their legacy systems, choosing not to take in consideration new management accounting techniques, it is unlikely that the future will bring a stabilization of management accounting practices (Hopwood, 1992; Yigitbasioglu, 2017).

The impacts identified from the development of technology are vast, some authors have even point out complex processes like an hybridization of accounting by the widening of competencies and practices, catalysed by ERP systems that, in accounting positions, force a reorganization of the organizational structure (Caglio, 2003; Kurunmaki, 2000). These processes have been described as opportunities for accountants, but for firms to fully benefit from the technological innovations, which can take the form of Information Systems (IS), knowledge is essential (Caglio, 2003; Lochner, 2013). The need for more knowledge may arise immediately in the design and implementation of such systems and

accounting plays an important role in such tasks and therefore, to assure the correct implementation of the new systems, accountants face more demand for IT knowledge (Dechow & Mouritsen, 2005; Sánchez-Rodríguez & Spraakman, 2012).

Assessing the impacts of such technological developments in the firms' overall performance, it is quite clear that a discussion around the business-value of IT emerged. This discussion was strongly connected with Management Information Systems (MIS) and Accounting Information Systems (AIS), to which AIS researchers gave fundamental contributions when organizations massively started to adopt ERP in the turning of the millennium, something that indicates a strong connection between IT and accounting (Sutton, 2010). Positive outcomes from IT utilization in the public accounting industry were first recorded in the beginning of the millennium, suggesting positive impacts from the implementation of audit software (Banker et al., 2002). With more research done in the area, the importance of IT became more evident, as it changed auditing through the integration of new applications, tackled better by the Big 4 firms (Janvrin & Bierstaker, 2015). The implications in firm profitability are also visible, the connection between IT budget levels and firm profitability shows that the allocation of more resources to IT investments, both in Hardware and Software, has positive impacts (Kobelsky et al., 2008). These impacts are not only direct, but also indirect, as IT reputation seems to have an influence lenders' terms. Firms with better reputation would be able to borrow with lower interest rates and more favourable non-price terms, as they achieve lower default and information risk (Kim et al., 2018).

From a business point of view, when it comes down to corporate application, the most important development that IT brought up in the 90's, were Enterprise Systems (ES) (Davenport, 1998). ES have been described as important to the further development of organizations, facilitating change (Rikhardsson & Kræmmergaard, 2006). As a result of the potential contribution to firms, an increase of investments in ES worldwide has been recorded, as well as positive outcomes from these implementations on management decision making (Dorantes et al., 2013). A particular interesting type of ES to accounting roles are ERP systems, that connect the different functional areas within an organization by integrating information and processes using configurable packages, also providing templates of advised best business practices (Kumar & Hilleberg, 2000). ERP systems are strongly connected with the processes of accounting by providing better understanding and manipulation capacity of the flows of operations and resources in a

firm environment (Chapman, 2005). The connection of ERP with accounting seems to be a popular topic of research, with researchers focusing on qualitative approaches to be able to produce stronger comprehensive information about the relationship between ERP and accounting information, an effort to achieve deeper understanding of this topic (Sardo & Alves, 2018). It is further noted that Best of Breed (BOB) systems are an accumulation of multiple software applications with specific designs for a particular function, each one is by itself a standalone system with an individual database, directed to fulfil specific user needs (Hermann, 2010). A comparative approach between BOB systems that are often chosen when the financial department is responsible for the introduction of the IS and only one specific objective is pursued, and ERP systems that usually are the choice when the motives are not only strategic but also technical, helps to understand the main reason for the popularity of the latter, showing the importance of the wider range of ERP systems (Hyvönen, 2003).

Some authors pointed out modest outcomes from ERP systems implementations and little impacts in accounting with the implementation of IS (Granlund & Malmi, 2002). However, more recent research gives further weight to the shift of accountants activities, that witness an increase in analysis´ related work while also highlighting that accountants must develop new abilities as ERP systems implementations are impacting accounting roles and creating a demand for different skill sets, even when job descriptions and the overall functions remain untouched (Balzli & Morard, 2012; Sánchez-Rodríguez & Spraakman, 2012).

System Applications and Products in Data Processing (SAP) established the standard for ERP software, being leaders in the production of software to manage business processes, mainly focused in building effective flows of information and data processing, across organizations through centralized data management that provides access to real-time insights (SAP, 2020). As it is widely accepted by enterprises, it makes sense to approach in more detail the adoption of SAP software. Authors have pointed out the fact that SAP transfers the featuring’s design to end users, who end up being the main responsible entities for the outcome of the implementation, meaning that the software does not, by itself, causes organizational change, as SAP is no more than an ‘absent presence’ (Quattrone & Hopper, 2006). However, the implementation of ERP systems like SAP can ultimately lead to changes in the work of the management accountants, even if authors are not sure that ERP systems are the only reason for these transformations. ERP systems

seem to eliminate routine jobs by integrating them, absorbing many routine accounting tasks (Scapens & Jazayeri, 2003). Even without the introduction of new techniques, there is an increase in forward-looking in forecasting. SAP creates an environment of team-working and cross-functional integration, even if one cannot be sure that it is the main driver of the management accounting changes described above (Scapens & Jazayeri, 2003).

As a possible answer to the difficulty that seems to exist when it comes to attribute the responsibility of organizational change to the implementation of ES, we may look to the adoption of these systems as a process and not as only a moment in time. Not only the technology adopted but the interactions with it create, in time, the changes that are being identified within the organizational context (Rikhardsson & Kræmmergaard, 2006; Wagner et al., 2011). Other authors point also to this necessity of looking to the implementation of new technology as a process that needs commitment from the organization professionals' to be successful, otherwise, even if a technology brings technical improvements, it will ultimately fail and may be discarded (van Akkeren, 2012).

Authors may not be sure if ERP systems are the only, or the main cause for change, but the changes in accountants' activities and practices exist, and these professionals try to redefine, reposition, and promote themselves. Such systems may stand as an opportunity where the accountants' skills and knowledge gain relevance, increasing their connection with a system that redefines their expertise at the same time they reshape the system (Sayed et al., 2006). ERP systems create a base for change through an environment of communication between professionals and the system itself, where each side may demand something to the other and increases visibility through trading zones (Dechow & Mouritsen, 2005).

On a more pragmatic perspective, authors have stated that the implementation of the SAP system catalyses the adoption of a Germanic accounting logic, embedded in the software itself, causing a transformation that strongly diverge financial and management accounting from each other. The software therefore defies enterprises to pursue some organizational changes and challenges accountants to develop new knowledge (Heinzelmann, 2017). ERP systems may also spread the accounting knowledge throughout the organization, enabling other professionals to perform accounting tasks (Quattrone & Hopper, 2005). The system may also push managers to perform management accounting tasks, but at the same time it opens a way for management

accountants to develop new knowledge and skills and to conquer a new space, more connected with the systems, assisting in creating strategies and decision making, more responsible for the systems implemented than for final reports (Scapens & Jazayeri, 2003).

It is also important in this research to approach other types of technologies besides ES that may have impacted accounting, directly or indirectly. A look into the evolution of auditing, now computerized and making its way to a continuous real-time process, and to Extensible Business Reporting Language (XBRL), another relevant innovation, helps us to understand the advantage of using standard software to effectively trade information (Rezaee et al., 2002). XBRL, the international standard for digital business reporting, consists on a language that allows transparent definition on reporting terms, achieving fast, accurate and digital reporting information flow (XBRL, 2020). Technology like XBRL, with the capacity to reduce the complexity of information search, will also contribute to computer-literate nonprofessional investors as it will make the use of financial statement easier (Efendi et al., 2016; Hodge & Kennedy, 2004). Whether exploring ERP systems that create an efficient flow of data, or standard software to reduce the complexity of communication, handling information seems to be an important aspect evolving the technologies with application in accounting. An accounting IT that enhances communication by reducing key entry and standardizing information is Electronic Data Interchange (EDI), that however still blurred with errors in orders' submissions by dealers, can increase department's performance after experience accumulation (Anderson & Lanen, 2002). EDI replaces the paper format and automates the transactions through a standard electronic format, authors have used the example of EDI to stress out that new technologies will have an impact for workers, sometimes even leading to loss of jobs (Premkumar et al., 1994). A similar technology, Real-Time Accounting (RTA), captures, measures, recognizes and reports electronically economic events, without using paper (Rezaee et al., 2000).

Artificial Intelligence (AI) is also present in accounting, most commonly in the form of Expert systems, software programs focused on solving problems without human interference (Zhao et al., 2004). A new and reliable computerized technique directed to disclosure measurement, that resort to artificial intelligence, has already been introduced. Artificial Intelligence Measurement of Disclosure (AIMD) operates, without the need of human judgment, using information from ten specific parameters: sales markets and

customers; employees; corporate environment; finance; corporate governance; R&D; social and environmental responsibility; capital markets; corporate strategy; value chain. AIMD is cost-effective and does not need human hand in the application phase (Grüning, 2011).

2.2 A changing environment

Pushed by new IT, globalisation forced companies to adopt different strategies, creating an open and more competent market that needed to be accompanied by new levels of efficiency (Duran, 2015; Halbouni & Nour, 2014). The dynamism present in today's global market is a result of the changes in the IT field (Rîndaşu, 2017), and it is constantly creating new gaps for enterprises to fill, a reality of continuous evolution at a fast pace (Smith, 2016). Some accounting firms have used IT to pursue these spaces and innovate, to find smaller operation areas, away from the excessive competition (Tomo et al., 2020). New technologies seem not only to encourage the pursue for new niches, but also to emerge in response to the identified gaps, developing more flexibility, economies of scale, mobility and accuracy (Rîndaşu, 2017). The search to fill these business gaps created by the open market, diluted professional boundaries, and although the main aspects of traditional professions like accounting remain the same, the static nature of the professional archetype may be exposed to forces that ultimately can alter this semi-static condition (Brock, 2006).

Accounting has been a part of the transversal business environment changes, suffering itself some mutations (Borisova & Bekhteneva, 2015). The opening of the markets since the 1980 increased competition levels and catalysed economical and business developments and in the early 90s raised challenges for the accounting profession, one of the first ones to feel the revolution that forced them to constantly adapt their knowledge and expertise (Duran, 2015; Rezarta, 2010). As described above, IT may be one of the cornerstones of this reshaped world we inhabit, shrinking the distances by enabling a more quick and efficient communication and with that it seems to be the main catalyser of changes in accounting by granting professionals easier ways to collaborate and new opportunities to progress and evolve (Duran, 2015; Nicolae, 2019). IT has undoubtedly impacted in great scale business operations with accountants hugely depending on part of it in their daily chores (Tam, 2013), because what is demanded from accountants

nowadays is not the same, as these professionals are pushed to acquire new and different skills (Alver & Alver, 2014; Halbouni & Nour, 2014). Therefore, new technologies may open the door for other, latent, potential directions for accounting (McGuigan & Ghio, 2019).

The new business environment is complex and dynamic and created the need for firms to resort to technology and often to external help in order to survive (Duran, 2015). Due to the velocity of the arrival of globalization, graduates were not prepared for a market environment (Mohamed & Lashine, 2003), where enterprises turn to new ways of dealing with information, resorting to new AIS.

2.3 A new reality for accountants

As written above, IT was a cause for the innovation of many sectors of activity, the development of a new way and faster way of communicating across the globe permitted new levels of collaboration, creating new opportunities for professionals to achieve new, more technical skills, in all areas of activity, including in accounting (Nicolae, 2019).

The process of change of the global market may be perceived as a process of evolution, and, therefore, it makes sense for accounting to evolve too, finding its place in the modern environment (Smith, 2016). For decades, accounting has witnessed a fusion of different services in response to market demands, causing changes which came at different paces, triggered by different situations with varied impacts. Accounting went through challenging times, in the 90's for instance the opening of the economy due to the globalization phenomenon pushed forward a profession revolution that would start to demand the development of new skills while also maintaining the knowledge that came with previous work experience (Rezarta, 2010). Through some negative events, that impacted the world economy, there have been times when the accounting profession lost some trust and respect, restored by laws, frameworks and guidelines, that induced further relevance in auditing and then caused the rise of consultancy services after a saturation in auditing, more steps in the process of evolution (Holtzman, 2004).

As organizations try to incorporate nowadays new technological tools, accounting professionals have also taken steps to fit better into the new business environment, pursuing IT education (Xavier et al., 2020). Accounting started to follow a path of more

technology efficiency, pursuing simpler solutions, in consequence of its development, accounting gained relevance and accountants too, as they widen their skillset, expanding their knowledge to include analysis, communication and IT capabilities (Borisova & Bekhteneva, 2015; Nicolae, 2019).

To access the changes in accounting one must look to ERP systems, recognized as one of the most important factors when it comes to the future aspects demanded from an accountant (Suhaimi et al., 2016). Some argue that ERP systems are not a synonym of “revolutionary change”, but recognize the impacts in the organizational structures of firms that implement them, improving efficiency of communication and practices (Granlund & Malmi, 2002; Quattrone & Hopper, 2005). Likewise, IT systems have been identified also as regulatory structures that impact the professional freedom of accountants, standardizing methods and procedures (Heinzelmann, 2018), and however some authors recognize greater impacts than others, the rise of ERP Systems is perceived as a relevant event that contributed to shift the accounting paradigm, which became more focused than ever in collecting, analysing and storing information.

The consequences may be different, but for sure they are real, impacting the roles and necessary skillsets of accountants that may hybridise and incorporate financial and information interpretation capabilities or, on the other hand, lose space after the ERP system implementation. ERP systems can be point to certain directions, but after the implementation they become more rigid (Hyvönen et al., 2009). ERP logic shapes into the organization an integrated standard of management accounting work (Heinzelmann, 2018), integrating inside the system itself various accounting processes, what obviously results in different tasks being demanded but also in different ways to complete these demanded tasks (Pervan & Dropulić, 2019). Therefore, it is important for accountants to be part of the implementation and to perceive ERP systems not as a threat but as a tool that must be used in order to reposition themselves (Newman & Westrup, 2005).

The majority of accounting professionals believe that technological innovation strongly impacted the sector, causing a structural transformation (Xavier et al., 2020). Some areas of accounting have evolved in a faster way than others (like auditing), but in general, not only the way of working in accounting is today different, but also the roles of accountants inside the modern corporations. Management accountants still maintain their traditional functions as the main ones (information provision, controlling, forecasting, budgeting, profit improvement and performance measurement and evaluation) but nowadays are

seen as the base of the change process which enterprises are forced to embrace, and are regularly adapted to new tasks and positions (Odia, 2019; Smith, 2016). RTA, extensible reporting language and artificial intelligence are examples of the extraordinary development in the accounting field, building up the idea that technology is playing a big part in the modifications that accounting is experiencing. Also, the increasing relevance of analytics and the new applicability of it, it is also an important aspect the path which the accounting sector is taking, lead to the reflection that the usage of analytics to predict or create strategies and to reduce the gap between the data generated and the reporting of it, should be key elements for accountants to achieve the new space in the marketplace (Smith, 2016; Zhao et al., 2004).

To achieve this new place it seems that the skillset might not be the same as it once were, at least not only, the market demands now more from accountants, but it is also demanded that accountants possess adequate IT knowledge to be able to accomplish the tasks that also evolved (Alver & Alver, 2014; Tam, 2013).

2.4 Different roles and responsibilities

As can be seen, technology impacted accounting in many ways, the techniques seem to be less malleable than the roles of accounting professionals, that are going through a process of change. Accountants are facing the need to reinvent themselves in some ways to remain competitive in an environment of fast communication that enable information to arrive at management desks before ever going through the hands of accountants, potentially diminishing the necessity of accountants in some traditional functions and forcing them to look for new opportunities (Suhaimi et al., 2016).

Figures identifying a lack of preparation to the new work environment in terms of necessary skills, namely in the poor knowledge of today's business technologies points out the changes in modern accounting positions, strongly suggesting that they were not accompanied at the same pace by education institutions (Greenstein & McKee, 2004). Management accounting, impacted by IT among other factors, needs to produce today more timely and accurate information to keep up with the production processes and cost structures, possibly resorting to information technologies connected with management accounting systems which indicate as well the need as well for IT training and the adaptation of accountants to being users of these new systems, analysing information

instead of producing it (Halbouni & Nour, 2014). Using auditing as an example, we may observe the threats that the profession faces due to the alterations in the preparation of financial statements, but we can also identify exiting opportunities like the development of continuous auditing (Zhao et al., 2004). Assurance is another good example of this, back in the beginning of the millennium the necessity to adapt was already being identified as the concept of continuous assurance was also seen as a soon to come reality (Elliott, 2002).

Data indicating a gap between the demands from accountants and their competencies strongly suggests that the process of evolution in terms of accountants roles and responsibilities is not finished yet, there is still some way to go in order to guarantee an appropriate fitting between the market, more and more inclined to business analytics. The bigger the company, the higher the probability of resorting to specialists instead of enabling company's controllers to acquire new knowledge, opening a debate about the need for controllers to pursue more advanced analytic and IT capabilities or to focus on a different niche, either way emphasizing the changes in their current tasks (Oesterreich & Teuteberg, 2019).

IT, mainly in the form of ERP systems, produced changes in the organizational structures and in the responsibilities of accounting employees. Even the studies that do not reflect a big impact on accounting practices, point to direct impacts in the roles of management accountants, replacing the higher amount of transaction handling to a more analytical work, with more decision-making responsibilities (Granlund & Malmi, 2002). Actually, there have been quite some content produced about the changes in the role of management accountants, mainly addressing the shift from bookkeeping to a more decision-making focus, one more proof of the evident changes in the sector (El-Sayed & Youssef, 2014). There is, however, evidence that the impacts of ERP systems may be even more vast, affecting data collection, reporting, analysis and budgeting, catalysing also changes in accounting job positions. After the implementation of such systems it is notorious an increase in the number of faster and more frequent reports, and it is also evident an emphasis put on analytical work, facts that once more highlight the need for modern accountants to develop, alongside the traditional ones, new skills better fitted for the new demands (Pervan & Dropulić, 2019).

Also, mainly due to innovations in IT and to IS in particular, a convergence of management accounting and financial accounting has been noticed, accompanying the

path of management accounting to a more future focus reality, based on strategy planning and control and the shift of financial accounting to become more immersed in fair value accounting, valuation purposes and decision-making. These facts also indicate a walk away of management accounting from functions of short-term planning or control and also of financial accounting from historical cost (Taipaleenmäki & Ikäheimo, 2013). The convergence of management accounting and financial accounting is just a part of the global organisational changes that an enterprise can go through when implementing ERP systems that also become “responsible” for some of the routine work of management accountants, inducing the occupation of different roles (Circa et al., 2015). If there is a debate about the consequences of adoption ERP systems or about their part in the construction of different forms of performing accountant tasks, both in a technical and in an objective point of view, the discussion about whether there are significant role changes or not seems to be less balanced, clearly favouring the evident presence of a role transformation.

Accounting professionals are expected today to master different contents and to possess distinct sets of technical knowledge from the previous generations, big companies seek another type of skillsets in today’s market, what explains the vast amount of different backgrounds of the graduates hired by some of big accountancy firms, figures that stress out the fact that the area is not what it once were. IT knowledge, analytical and technological skills are the main characteristics that seem to dictate the hiring process in such firms (Kotb et al., 2019).

2.5 A look into the future – Adaptation is key

To look into the future, one must look into education, after all, the academic paths of today’s accounting students will greatly influence the expertise and the degree in which such professionals will fit their positions once they enter the job market.

Due to the changes suffered by the area in recent years an important characteristic of accountants nowadays is the adaptation capability and to possess such advantage one must be comfortable in different areas of expertise, but what knowledge and which technical skills should be top priorities for institutions today, when building up the accountant’s curriculum? If the roles and responsibilities changed, the accounting graduate profile that businesses look for must have also evolved. Studies are indicating

the need to incorporate more skills related to IT knowledge into the curriculums of accounting graduates, enabling them to be more prepared for the demands they will face once they end up their academic path and start to enrol in different, modern businesses (Andiola et al., 2020b; Kotb et al., 2019; Pervan & Dropulić, 2019). IT naturally seems to be perceived as a cornerstone of an optimal accounting curriculum, data from the last decade shows that analytical/critical thinking is perceived has the most important skill both by accounting graduates and employers, while the least important ones are technical and functional skills, however maintaining a considerable degree of importance attributed both by graduates and employers (Ainsworth, 2001; Awayiga et al., 2010). At the beginning of the millennium, along with analytical/critical thinking, communication and decision-making were other skills perceived as the main ones when it came to accountants and employers' perceptions, at the time it was already considered that a generic computer course would not be enough to prepare accounting students to the developments in IT, even when combined with a accounting systems class, the preferred approach should be one of technology integration throughout the other classes and an accounting systems class (Burnett, 2003).

Other data points out the clear transformation in the demands for professionals working in accounting in today's market, like the significant number of non-accountants hired by big accounting firms in a chase for more differentiated knowledge, mainly focusing on analysis and technology (Kotb et al., 2019). There have been changes in the architecture of accounting programs, but not only there is a wide range when it comes to the level of technology and analytical skills taught but the process has also been slow and incapable of keeping up with the speed in which the market demands are evolving (Andiola et al., 2020b).

The evolution of technology is happening in a continuum spectrum, new applications for accounting will continue to be developed, like the ones related to internet and others embedding AI, which may be perceived by accountants as a threat but they may also pose as an opportunity for those who can adapt to the new environment (Moll & Yigitbasioglu, 2019). Accountants must adapt to new technological demands but there are authors that also suggest a need for accounting professionals to develop other capabilities like creativity, innovation, holistic thinking, decision-making and sense-making, in order to better tackle the changes in the sector and to maintain the relevance of the profession in a new environment (McGuigan & Ghio, 2019).

Academic institutions should not only understand the new roles of accountants in the modern environment, adjusting graduates' profiles to the demands of the business market, but also look to the future to provide them with the adaptation capabilities that will enable them to conquer their space in the job market, maintaining the relevance of the profession (Odia, 2019).

3.

3.1 Research Question

How have authors approached the relationship between accounting and technology and what is the nature and extend of such connection?

3.2 The importance of this review

The advances that organizations suffered in their internal processes, from the alteration of the external environment, are tangible (Arnaboldi et al., 2017). Accounting is clearly enrolled in this progressive technological path that businesses are going through (Chang et al., 2011) with technologies constantly evolving, pressuring an increasingly competitive environment to obtain frequent adaptations (Ghasemi et al., 2019; Pérez-Méndez & Machado-Cabezas, 2015). With the changes in accounting there will be a necessity to adapt some aspects regarding the accountants' profile (Odia, 2019; Suhaimi et al., 2016). With this review we try to occupy an apparent gap concerning how to access the recent proximity of accounting and technology.

3.3 Objectives

With a deep assessment of the relationship between accounting and technology and an understanding of the ways which have been used by authors to tackle this topic we hope to provide relevant insights on how to approach the topic in a more efficient way, enabling individuals and institutions to better prepare for current and future changes in the sector.

4. Methodology

In order to set the context for the review, find out how much literature exists on the topic, the characteristics of such literature and properly develop the strategy used for the selection of studies, a broader scoping of studies was executed. To execute this broader reading that is present in the chapter “Literature Review” the approach was focused on guaranteeing that wide range of studies would be included, in order to efficiently identify research gaps and design the methodology used. As a way of being more familiarised with the topic, the literature search resorted firstly to an initial search using an electronic database, Scopus, that served as a base to decide how the search for the “Literature Review” would be conducted (Booth et al., 2016).

For the second part of the literature searching process four electronic databases were used, Web of Science; Scopus; Business Source Complete; Academic Search Complete, for a free-text searching using the words “Accounting”, “Accountants”, “Technology” and “Change”. The choice of the electronic databases used was based on the list of specific and multidisciplinary common electronic databases available proposed by Booth, Sutton and Papaioannou (Booth et al., 2016).

From the analysis of the studies related to the topic of this dissertation, a theoretical overview of the work produced in the past gave place to the second chapter of this dissertation, following the method proposed by Tranfield, Denyer and Smart (Tranfield et al., 2003). It was with the knowledge obtained from the broader overview that the parameters for the selection of studies were chosen.

The preliminary broader search resulted in an amount of studies too big for the analysis intended and so, to reduce the amount of studies, only one electronic database was used to conduct the search. Web of Science was the research engine chosen. A few parameters were implemented to ensure the relevance of the information retrieved, namely, date range, document type, subject area and keywords. To apply such parameters tools available in the electronic database that provided a limit function were used, resorting

once more to methodology proposed by Booth, Sutton and Papaioannou (Booth et al., 2016).

Because the intent was to base this research in the impact of technological innovation in accounting, and because the background scope indicated clearly that the main changes started to appear in the turning of the millennium, the date range defined was between 2000 and present, being the search conducted in June 2020 that was the upper limit of the search. For the document type, “Article” was chosen as a parameter for the search in a way to ensure that only primary sources reporting the methods and results of an original study were used in this Systematic Literature Review. Having in mind the main area where this research is inserted in, the subject area “Business, Management and Accounting” was also defined to filter and focus this research in the right direction.

After evaluating the keywords used in the studies primarily analysed, an advance word search was conducted in Web of Science based on the words, “Accounting”, “Accountants”, “Technology” and “Change” and in the fields “Topic” (TS), “Title” (TI), “Abstract” (AB) and “Author Keywords” (AK) that, due to its complexity it is fully described below:

TS=(technology AND change AND Accountants) OR TI=(technology AND change AND Accountants) OR AB=(technology AND change AND Accountants) OR AK=(technology AND change AND Accountants) // TS=(technology AND change AND Accounting professionals) OR TI=(technology AND change AND Accounting professionals) OR AB=(technology AND change AND Accounting professionals) OR AK=(technology AND change AND Accounting professionals)

To evaluate the relevance of the studies that would be included and analysed in the next chapters of the dissertation a detailed evaluation of the studies was conducted. To do so, after the search through the search engine, a process similar to the selection process proposed in (Booth et al., 2014) and described as the most efficient way of screening.

The process consisted on three steps, a Title Sift and an Abstract Sift and a Full Text Sift, as shown in figure 1. In the first step, the studies were analysed considering two main aspects. If they do not indicate that the topic is an object of interest of this research they would be excluded, or, on other hand, if they limit the research to a specific topic not directly related to the impact of technology in accounting they would also be excluded.

On the second step of the process, several aspects were taken into consideration before the decision to exclude or include the studies. Firstly, the data collection method, excluding forms of research that do not handle their own data, with the exception of four specific articles for which the reason for inclusion will be explained further. Secondly the main focus of the study that should contain the aspects surrounding topic of the dissertation in order to be included.

The third step was conducted also taking into consideration to the methodology proposal of (Tranfield et al., 2003), that indicates the possibility of a detailed evaluation of the full text of some articles from relevant sources. So, for some articles that had left some doubts at the second step of the process, a Full Text Sift was conducted to better evaluate the possibility of inclusion in the selection. Namely, for the articles (Botez, 2018; Elliott, 2002; Joseph, 2006; McGuigan & Ghio, 2019; Moll & Yigitbasioglu, 2019; Worster et al., 2016), in spite of not making “raw data” available to the systematic review a decision was made to include the studies based on the subjective conclusions presented and the considered relevance to the topic of this dissertation.

The result of the selection process indicated 18 studies to be included in further and deeper analysis, the selection process is presented in the table present in Appendix A.

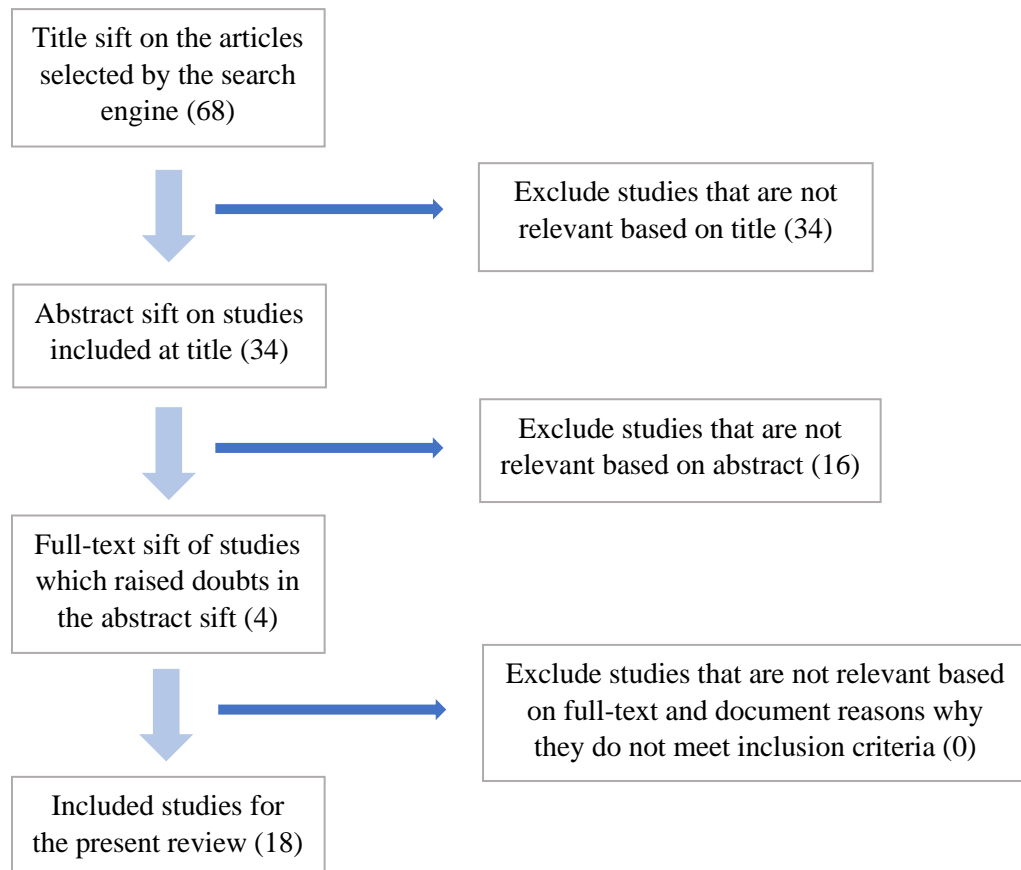


Figure 1. Schematic figure illustrating the process of selecting studies. Adapted from Booth et al., 2016. Values within parenthesis correspond to the number of articles in each step of the selecting process.

5. Data analysis

To be able to answer the initial question of this research, “How have authors approached the relationship between accounting and technology and what is the nature and extend of such connection?”, each study was classified in accordance to four variables, “subject”, “country/origin of data”, “year” and data collection method”. The subject was chosen in order to perceive what was the focus of each study. The origin of data was included as a variable to measure the geographical range of the studies. Year was a variable chosen to evaluate the temporal distribution of the sample inside the defined timeframe. Finally, the data collection method was also included to provide information regarding the approaches employed by the authors.

Due to the qualitative feature of the research conducted, the data analysis that followed was elaborated resorting to a specific software, namely SPSS (Statistic Package for Social Sciences) (IBM Corp., 2017). The software enabled the information to be handled according to the variables implemented. The information retrieved through the classification of each study into the four variables is represented by quantifying the absolute number of occurrences and the respective frequencies.

In SPSS, after the selection of variables in the “variable review” and the insertion of the data in the “data view” the functions used were based on the descriptive statistics subject, specifically on the analysis of frequencies and crosstabs.

As described in the previous chapter, SPSS was the software used, as it is an important tool that turns information obtained into graphics and tables that allows the public to understand, in a simpler way, the results about every research. Since the literature review of this thesis was mainly qualitative, the information obtained had to be converted into several quantitative variables such as “subject”, “country/origin of data”, “year” and data collection method”. It is important to note that in the graphic illustrations used, the percentages displayed have been rounded to one decimal number for easier visual comprehension of the data.

After the steps of article selection, the final sample reviewed was reduced to eighteen articles, developed in eleven different countries, from 2002 to 2020, resorting to seven different data collection methods and subordinated to ten different subjects surrounding the topic of this dissertation, such as “IT”, “ERP”, “Professional Changes” or “New Role of Accountants”.

The following table illustrates the final selection of studies and the analysis of the variables selected:

Table 1. Articles selected for the systematic review. Columns "Year", "Subject", "Data collection method" and "Country" correspond to the variable classification

Author	Title	Year	Source	Subject	Data Collection Method	Country
Paolo Quattrone & Trevor Hopper	A time-space odyssey: management control systems in two multinational organisations	2005	Accounting, Organizations and Society	ERP	Case Study	Multinational
Nicholas McGuigan & Alessandro Ghio	Art, accounting and technology: unravelling the paradoxical "in-between"	2019	Art, Accounting and technology	Accounting into artistic spaces	N/A	Australia
Durán & Yosmary	Contabilidad bajo el enfoque de Tecnologías de la Información y Comunicación (TIC's).	2015	Visión Gerencial	IT	Survey	Venezuela
Micheal Fraser	Fleshing out" an engagement with a social accounting technology	2012	Accounting, Auditing and Accountability Journal	Social Accounting Technology	Case Study	New Zealand
Christie Hayne & Clinton Free	Hybridized professional groups and institutional work: COSO and the rise of enterprise risk management	2014	Accounting, Organizations and Society	ERM	Interview	Canada and USA
Andrea Tomo, Gianluigi Mangia & Stefano Consiglio	Information systems and information technologies as enablers of innovation and knowledge creation and sharing in professional service firms	2020	Technology Analysis and Strategic Management	Information System	Survey	Italy
Amr Kotb, Magdy Abdel-Kader, Amir Allam, Hussein Halabi & Ellie Franklin	Information technology in the British and Irish undergraduate accounting degrees	2019	Accounting Education	Professional Changes	Survey	UK and ROI
Timo Hyvönen , Janne Järvinen , Jukka Pellinen & Tapani Rahko	Institutional Logics, ICT and Stability of Management Accounting	2009	European Accounting Review	Professional Changes	Operational Statistics	Finland
Mike Newman & Chris Westrup	Making ERPs work: accountants and the introduction of ERP systems	2005	European Journal of Information Systems	ERP	Mixed Methods	UK
Art Worster, Thomas R. Weirich & Frank Andera	Managing IT Change—Sales, Marketing, and Distribution	2016	Corporate accounting and finance	ERP	N/A	USA
Heba El-Sayed Mayada Abd El-Aziz Youssef	Modes of mediation" for conceptualizing how different roles for accountants are made present	2015	Qualitative Research in Accounting & Management	New Role of Accountants	Interview	Egypt
Rafael Heinzelmann	Occupational identities of management accountants: The role of the IT system	2017	Journal of Applied Accounting Research	IT	Interview	Austria, France and UK
Daniel Botez	Recent Challenge for Auditors: Using Data Analytics in the Audit of the Financial Statements	2018	Broad Research in Artificial Intelligence and Neuroscience	Data Analytics	N/A	Romania
Ivica Pervan & Ivana Dropulić	The impact of integrated information systems on management accounting: Case of croatia	2019	Management	ERP	Survey	Croatia
Thuy Duong Oesterreich & Frank Teuteberg	The role of business analytics in the controllers and management accountants' competence profiles	2019	Journal of Accounting and Organizational Change	Big Data	Social Network	Germany
Jodie Moll & Ogan Yigitbasioglu	The role of internet-related technologies in shaping the work of accountants: New directions for accounting research	2019	The British Accounting Review	IT	N/A	UK and Australia
Keith Robson , Christopher Humphrey, Rihab Khalifa & Julian Jones	Transforming audit technologies: Business risk audit methodologies and the audit Weld	2007	Accounting, Organizations and Society	BRA methodologies	Interview	UK
Robert Elliott	Twenty first centurt assurance	2002	Auditing	IT	N/A	USA

5.1 Subject

When choosing the variables to analyse, the subject was considered an interesting characteristic since it indicates the main focus of each author when conducting a research, pointing out the main interest of the article itself. By looking to the subject, one may construct an idea on which are the most relevant themes surrounding the topic of this dissertation and therefore understand what are the primal aspects that have been looked at when accessing the relationship between accounting and technology.

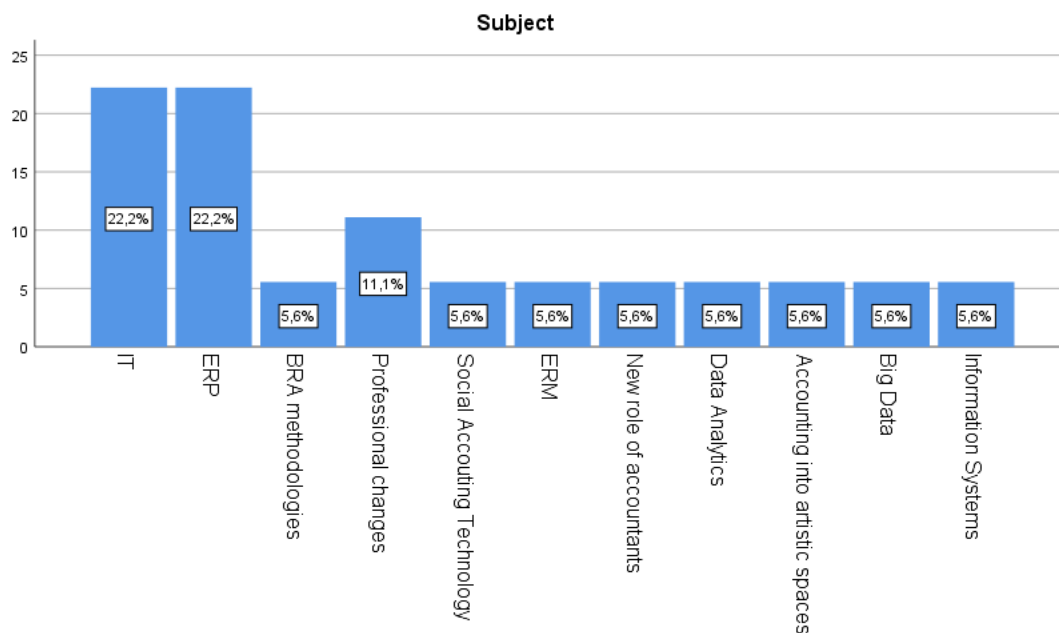


Figure 2. Percentage of articles in each category of the variable "subject".

As the graph shows, the most common topics approached by authors are ERP and IT, evidence of the clear perceived impact that IT in general and ERP specifically seem to have in the accounting field. In this research, there were identified four valid cases of IT or ERP subjects, representing each 22,2% and in aggregate 44% of the sample, close to half of the valid cases. If other forms of IT were considered in the subjects of the studies accessed, namely “Big Data” and “Information systems”, the conclusion would be that IT or forms of IT constitute more than half of the observations. It is therefore safe to assume that IT has been generally perceived as a relevant matter when looking at accounting over the previous decades. This data agrees with researches that pointed out

the attention that authors in accounting have been giving to emerging technologies since the year 2000 (Chiu et al., 2019).

It is also interesting to understand that after IT and ERP, “Professional Changes” is the subject more present in the researches analysed. The subject “New Role of Accountants” has also been used in one of the studies approached, what means that overall, the changes suffered by accounting professionals have been also a topic of interest for researchers, representing 17% of the total observations. This evidence may pose as an indicator of the mutations suffered by the accounting profession and felt by accountants in their daily routine, something that some authors have been stressing out (Borisova & Bekhteneva, 2015; Circa et al., 2015; Duran, 2015; Pervan & Dropulić, 2019; Rezarta, 2010; Suhaimi et al., 2016) .

5.2 Country

The background review indicated that globalization may have been in the centre of some of the technologies that impacted accounting, due to the efforts to develop ways of reducing distances and breaking down barriers, creating an optimal environment to the arise of different forms of IT (Duran, 2015; Halbouni & Nour, 2014). Also bearing in mind the contributes of some authors that stress out the fact that technological advances had an impact in accounting (Elliott, 1998), the choice of accessing the country of origin of the data or the country where the research was conducted was based on the possibility to evaluate if the topic of this dissertation was transversally perceived as an interesting research matter and connect this information with those beliefs that globalisation was a catalyser for the beginning of a tighter relationship between accounting and new technologies.

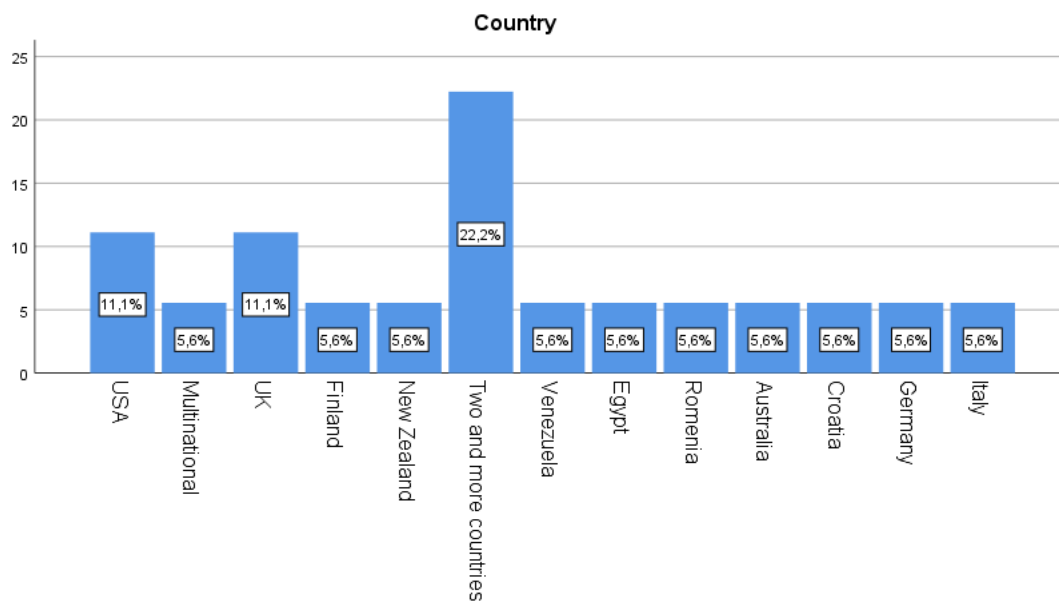


Figure 3. Percentage of articles in each category of the variable "country".

The data shows that in fact the topic has been a matter of discussion and research in different countries. However not visible in the chart, the studies that have been conducted in more than one country also contribute to the presence of new observations, namely the Republic of Ireland, Canada, France, and Austria. In total, 15 different countries are present in the observations. However it is clear that the UK and the USA are the countries where most of the articles present in the sample have been conducted, breaking the data into continents would lead to the conclusion all continents, except Antarctica, isn't represented in the sample, considering Egypt a transcontinental country part of Africa and Asia, or if opting for a geopolitical analysis that allocates Egypt to Africa, only two continents are missing from the observations while five are present, Europe, Africa, Australia, North America and South America. This data confirms the global nature of the matter and the interest that researchers all around the globe have in the topic, indicating that the connection of technology with accounting it is not an isolated situation but a general one.

5.3 Year

To understand the evolution of the topic throughout the timeframe defined, the year of publication of the article was chosen as a variable in the data analysis conducted. The inclusion of the year as a variable contributes to having a perspective of how authors have looked to accounting and technology in the past two decades.

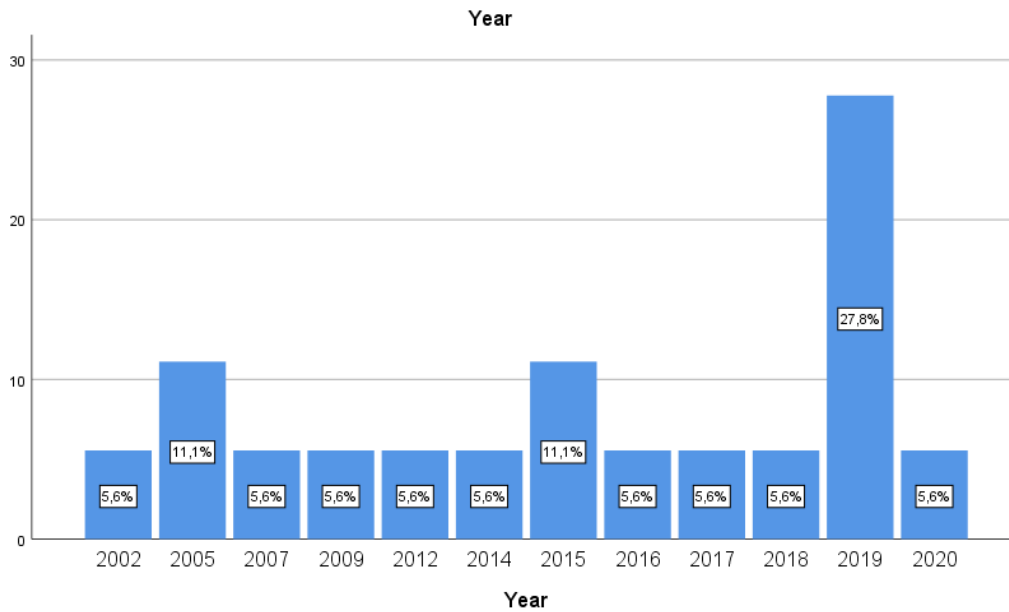


Figure 4. Percentage of articles in each category of the variable "year".

Looking to the data it is visible that the topics concerning accounting and technology have been present in the researchers work in the last twenty years. The sample itself illustrates that in the time-frame established, from the year 2000 to 2020, the gaps without researches have not been greater than two years, a significant figure to back up claims that stress out that the topic has been present in the works of accounting researches in the past years since the year 2000 (Chiu et al., 2019).

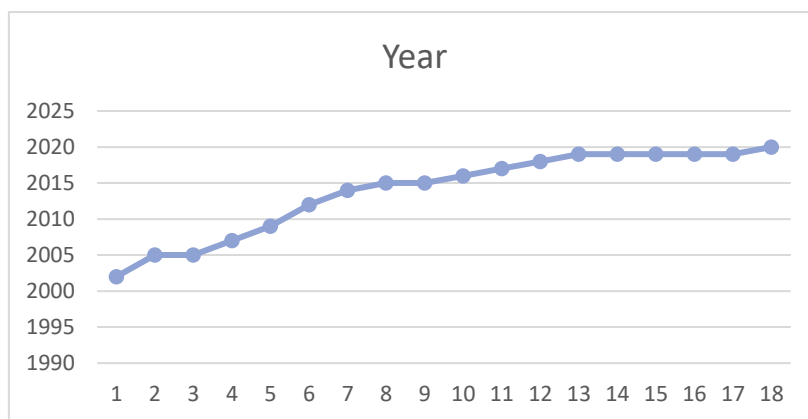


Figure 5. Cumulative number of articles per year.

One can also perceive in the data collected that in the second decade of the timeframe there are more relevant work to the topic being produced, as the observations of studies elaborated since 2010 represent roughly 75% of all observations, what can be an indication of an increasing relevance attributed to the topic by the accounting research community. On top of this, the sample shows around 28% of the observations in 2019 alone, what could be another indicator of that increasing relevance, however, such deduction cannot be made, as only one article from 2020 is a part of the sample. The modest number of articles selected from 2020 may be related to the time when the research was conducted, June 2020, reducing the studied period of that year in comparison to that of the other years present in the sample.

5.4 Data Collection Method

Understanding how the researches that have been looking into the subjects surrounding the topic of this dissertation decided to collect data can help to understand the characteristics of the relationship between accounting and technology, in the sense that the approaches to the questions formulated can show how authors believed it was possible to better tackle them in search for answers, creating a clearer image of the nature of this relationship between accounting and technology through the designs in which it is studied.

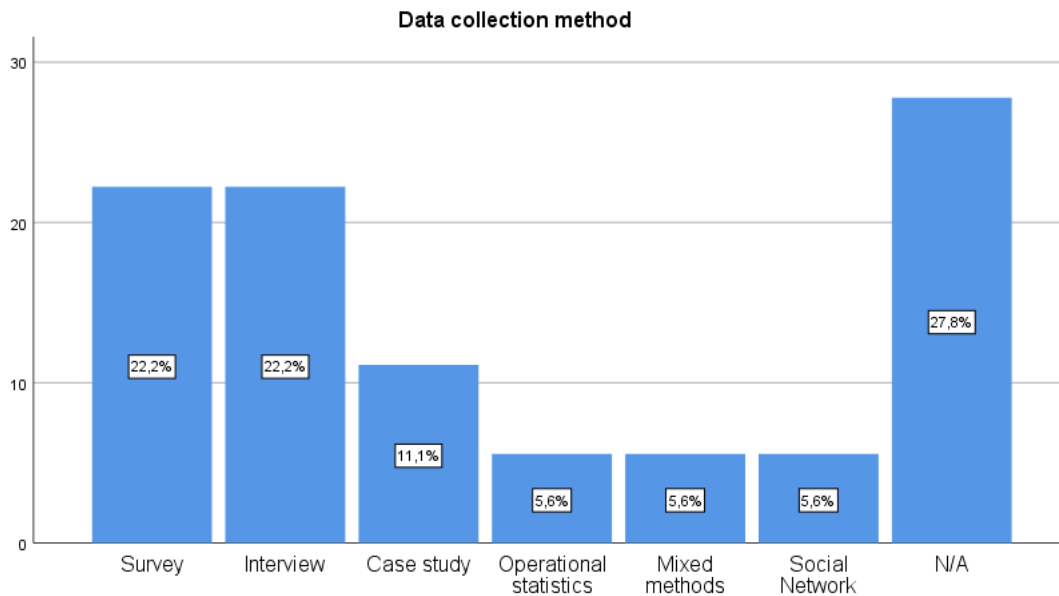


Figure 6. Percentage of articles in each category of the variable "Data collection method".

Firstly, it is important to note in the data that most observations indicate the use of purely qualitative methods for data collection in the studies that are part of the sample analysed. This evidence points to the importance of accessing the topic in an exploratory manner with in-depth analysis.

The amount of observations where the research resorted to specific qualitative data collection approaches, surveys and interviews, represent almost half of the observations, roughly 44%, what gives strength to the idea of analysing the topic by understanding the perceptions of people involved in the processes that relate technology and accounting. It is also important to note that case studies represent around 11% of the observations, evidencing the need to conduct researches through real-life situations, once more indicating that the relationship between technology and accounting is tangible and must be evaluated resorting to in specific contexts.

5.5 Subject and Year

In this part of the statistical analysis the relation between variables was analysed to relate the variables and understand how they connect to each other. To do so a cross tabulation was used to summarize the data and determine if associations between variables would be identified.

Firstly, it was decided to look at the association between subject and year, to understand if it was possible to detect tendency throughout the period of sampling.

Table 2. Association of the variable "subject" with the variable "year".

Subject		Year												Total
		2002	2005	2007	2009	2012	2014	2015	2016	2017	2018	2019	2020	
IT		1	0	0	0	0	0	1	0	1	0	1	0	4
ERP		0	2	0	0	0	0	0	1	0	0	1	0	4
BRA methodologies		0	0	1	0	0	0	0	0	0	0	0	0	1
Professional changes		0	0	0	1	0	0	0	0	0	0	1	0	2
Social Accounting Technology		0	0	0	0	1	0	0	0	0	0	0	0	1
ERM		0	0	0	0	0	1	0	0	0	0	0	0	1
New role of accountants		0	0	0	0	0	0	1	0	0	0	0	0	1
Data Analytics		0	0	0	0	0	0	0	0	0	1	0	0	1
Accounting into artistic spaces		0	0	0	0	0	0	0	0	0	0	1	0	1
Big Data		0	0	0	0	0	0	0	0	0	0	1	0	1
Information Systems		0	0	0	0	0	0	0	0	0	0	0	1	1
Total		1	2	1	1	1	1	2	1	1	1	5	1	18

From analysing the subject and year together no relevant information can be extracted from the data, as the number of observations are considered small to be able to understand some pattern.

5.6 Subject and Origin of Data

Trying to detect some culture influences in the choice of the subject when conducting researches in this topic, the second association done was between subject and origin of data.

Table 3. Association of the variable "subject" with the variable "country".

Subject		Country												Total	
		USA	UK	New Zealand	Finland	Venezuela	Italy	Croatia	Germany	Australia	Two and more countries	Romania	Multinational		Egypt
IT		1	0	0	0	1	0	0	0	0	2	0	0	0	4
ERP		1	1	0	0	0	0	1	0	0	0	0	1	0	4
Social accounting technology		0	0	1	0	0	0	0	0	0	0	0	0	0	1
New role of accountants		0	0	0	0	0	0	0	0	0	0	0	0	1	1
Big Data		0	0	0	0	0	0	0	1	0	0	0	0	0	1
Professional changes		0	0	0	1	0	0	0	0	0	1	0	0	0	2
ERM		0	0	0	0	0	0	0	0	0	1	0	0	0	1
Accounting into artistic spaces		0	0	0	0	0	0	0	0	1	0	0	0	0	1
BRA methodologies		0	1	0	0	0	0	0	0	0	0	0	0	0	1
Information system		0	0	0	0	0	1	0	0	0	0	0	0	0	1
Data Analytics		0	0	0	0	0	0	0	0	0	0	1	0	0	1
Total		2	2	1	1	1	1	1	1	1	4	1	1	1	18

Once more, the small amount of observations makes it difficult to produce clear deductions from the association table, however, one can note the fact that IT, in general or in specific forms, ERP, Big Data, Information Systems, is a subject looked at in different countries, a figure that one more time agrees with the perception that IT is strongly connected with globalisation having implications in world wide.

5.7 Subject and Data Collection Method

To understand if authors tackle in particular ways the questions raised about specific subjects, the association of subject and data collection method was done.

Table 4. Association of the variable "subject" with the variable "Data collection method".

Subject		Data collection method							Total
		Survey	Case study	Interview	Operational Statistics	Mixed methods	N/A	Social Network	
IT		1	0	1	0	0	2	0	4
ERP		1	1	0	0	1	1	0	4
Social accounting technology		0	1	0	0	0	0	0	1
New role of accountants		0	0	1	0	0	0	0	1
Big Data		0	0	0	0	0	0	1	1
Professional changes		1	0	0	1	0	0	0	2
ERM		0	0	1	0	0	0	0	1
Accounting into artistic spaces		0	0	0	0	0	1	0	1
BRA methodologies		0	0	1	0	0	0	0	1
Information system		1	0	0	0	0	0	0	1
Data Analytics		0	0	0	0	0	1	0	1
Total		4	2	4	1	1	5	1	18

Having in mind that, as mentioned above, the small number of observations poses as an obstacle, the table still shows an interesting fact concerning the data. It seems that no association can be made between subject and data collection method. Even looking into IT and its specific forms in an aggregative form, as we have done before to gain some expression in the amount of data, there is not a clear relation. Several different methods seem to be used by authors to develop their researches on IT, clearly showing that different approaches have been chosen when producing information on the matter.

SUMMARY, LIMITATIONS AND CONCLUSIONS

6. Limitations

These results have several limitations. The first that it can be emphasized is the used time frame. Since only half of the year 2020 was considered due to the date in which of the studies were searched using the electronic data base, June 2020, this could have resulted in a reduction of the number of studies that fell into the established parameters for the search and selection processes. Also, the low number of studies from the year 2020 could have influenced the analysis of the variable “year” and its association with other variables.

The low number of studies incorporated means that a small sample was available for the analysis, reducing the confidence of the conclusions. The low number of studies may be caused by the excessive rigid parameters for the studies selection. In the future a less rigid selection should be used to increase the data set.

Usually a systematic review conducted by two or more reviewers may ensure improved reliability, reproducibility and quality guarantying minimized errors and bias. The fact that this research was done by a single reviewer may have increased the possibility of selection bias, information bias and analysis bias.

7. Discussion and Conclusions

The literature review conducted before the systematic review indicated that accounting was impacted by technology, mainly by IT (Sutton, 2010). The results from the systematic review illustrate that authors are giving importance to IT, approaching the subject as a whole or specifically focused on particular types of IT. The conducted analysis, shows that the subjects directly related with IT represent around 56% of the observations, indicating the relevance attributed to IT.

In accordance with what is patent in the literature review about the connection of globalization to the process that accounting is going through due to technological innovation, the systematic review made it possible to analyse the geographical range of the observations. Despite a small sample, it revealed a vast number of countries distributed across most continents. Besides, based on the results, one can stress out the fact that the observations displayed interesting differences when it comes to the characteristics of countries where the studies are originated from. These considerations go in agreement with the literature, as they show that the topic is being approach by authors all over the globe.

Since the year 2000 there has been noted a considerable relevance given by accounting researchers to the relationship between technology and accounting, and the data from the systematic review also points to this fact as it shows that no more than two years pass by without an article tackling this issue. The year 2019 was the year with the highest rate of articles focusing on subjects surrounding the topic, however this result may be biased by the smaller period of sampling for the year 2020.

From the results of the data analysis concerning the data collection method, one may perceive the importance of conducting research about this topic inside a business environment. Many of the studies in the sample resorted to purely qualitative methods for data collection, pointing out the importance of accessing the topic in an exploratory manner with in-depth analysis. Such evidence goes into accordance with information provided by the literature review that note that the impacts of technology varies accordingly to the permeability of enterprises to the new technological applications in the field (Caglio, 2003).

Authors have stated that hiring processes have changed, the demands from accountants are different, new skills and knowledge are searched today to better fit the professional

profiles of accountants into the evolved structures of organizations (Alver & Alver, 2014; Kotb et al., 2019; Tam, 2013). Based on the data from the systematic review, after IT and ERP, “Professional Changes” is the subject more present in the researches analysed. “New Role of Accountants” has also been used in one of the studies approached, what means that overall, the changes suffered by accounting professionals have been also a topic of interest for researchers, representing 17% of the total observations.

Accounting professionals are expected today to master different contents and to possess distinct sets of technical knowledge from the previous generations. Some accounting activities left the hand of accountants as the demand for other ones is increasing and the rising of new opportunities and demands are clear. There are threats but also opportunities. Accountants are losing space in some of their traditional roles but gaining relevance in others (Ainsworth, 2001).

To achieve new positions accountants must possess different characteristics but there is still a gap between the demands from accountants and their skills (Greenstein & McKee, 2004; Oesterreich & Teuteberg, 2019).

A new accountant curriculum must be fabricated by academic institutions which must understand that the roles of accountants changed and react to this new reality in a fast and effective manner to guarantee the maintaining relevance of the profession. Not only should academic institutions react but they should also act, technology must be embedded in the new curriculums as the development of innovative applications in the field will probably keep surfacing, accounting students must be tailored to adapt to constant changes in the sector (McGuigan & Ghio, 2019; Moll & Yigitbasioglu, 2019; Odia, 2019).

In summary, this research shows that the relationship between technology and accounting is a hot topic with new articles being published constantly. It also points out that the preferred ways to approach the problematics concerning these topics are through in-depth studies that feed on qualitative methods which explore business routines, employee feelings and thoughts. In addition, IT as a whole or in specific forms, such as ERP and information systems, appear to be the subjects that arise more interest from authors, what emphasizes the importance that IT is having on the sector. Finally, attention must be given to the number of relevant studies elaborated about the impact of technology verified in the accounting sector and felt by accountants which show that technology is acting as a factor of change for accounting in today’s business environment.

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Appendixes

Appendix A - Selection of studies

Table 5. Used articles and selection process

Author	Title	Year	Source	Title Sift	Justification	Abstract Sift	Justification
Maxine Saborowski, & Ingrid Kollak	"How do you care for technology?" – Care professionals' experiences with assistive technology in care of the elderly	2014	Technological Forecasting & Social Change	no	The Title suggests little relevance to the topic		
Naidoo	A communicative-tension model of change-induced collective voluntary turnover in IT	2016	Journal of Strategic Information Systems	yes		no	The research is focused on IT professionals in an healthcare insurance firm's IT unit, not directly concerning the changes for accounting
Elmarie Engelbrecht	Adapting to changing expectations: Post-graduate students experience of an e-learning tax program	2005	Computers & Education	no	To focused on a particular process not directly related to the impact of technology in accounting		
Paolo Quattrone & Trevor Hopper	A time–space odyssey: management control systems in two multinational organisations	2005	Accounting, Organizations and Society	yes		yes	
Anura De Zoysa Sriyama Kanthi Herath	Standard costing in Japanese firms"	2007	Industrial Management & Data Systems	no	To focused on a particular process not directly related to the impact of technology in accounting		
N. D. Sexton	Accounting students' perception: Internal control theory moves outside the classroom and online	2019	South African Journal of Higher Education	yes		no	Although the research is focused on information on IT, it focuses on accounting students' perceptions and pervasive skills using Facebook
Michela Arnaboldi, Cristiano Busco & Suresh Cuganesan	Accounting, accountability, social media and big data: Revolution or hype?	2017	Accounting, Auditing & Accountability Journal	yes		no	Literature Review
Nicholas McGuigan & Alessandro Ghio	Art, accounting and technology: unravelling the paradoxical "in-between"	2019	Art, Accounting and technology	yes		yes	A Full Text Sift was conducted to evaluate the relevance of the study
Durán & Yosmary	Contabilidad bajo el enfoque de Tecnologías de la Información y Comunicación (TIC's).	2015	Visión Gerencial	yes		yes	
Awni Rawashdeh	Factors affecting adoption of internet banking in Jordan: chartered accountant's perspective	2015	International Journal of Bank Marketing	yes		no	Related to the factors affecting the adoption of certain technological innovation, not the opposite
Doug Henton & Kim Held	The dynamics of Silicon Valley: Creative destruction and the evolution of the innovation habitat	2013	Social Science Information	no	The Title suggests little relevance to the topic		
Micheal Fraser	"Fleshing out" an engagement with a social accounting technology	2012	Accounting, Auditing and Accountability Journal	yes		yes	
Stefan Schaltegger Dimitar Zvezdov	Gatekeepers of sustainability information: exploring the roles of accountants	2015	Journal of Accounting & Organizational Change	yes		no	The focus of the research is involvement of accountants in managing sustainability information
Christie Hayne & Clinton Free	Hybridized professional groups and institutional work: COSO and the rise of enterprise risk management	2014	Accounting, Organizations and Society	yes		yes	
Christina Ling-Hsing Chang, Victor Chen, Gary Klein & James J Jiang	Information system personnel career anchor changes leading to career changes	2011	European Journal of Information Systems	yes		no	The research relates the career changes of IS employees with the changes in the career anchors, therefore it deviates from the topic of the dissertation
Andrea Tomo, Gianluigi Mangia & Stefano Consiglio	Information systems and information technologies as enablers of innovation and knowledge creation and sharing in professional service firms	2020	Technology Analysis & Strategic Management	yes		yes	
Ali Mohammad Taghavi, Hamzeh Kazemi, Zahra Rahnama & Ebrahim Moradyan	Investigating Benefit Management on Stock Return and Book Value of Stock in Listed Financial Distressed Firms in Stock Exchange	2016	International Journal of Advanced Biotechnology and Research	no	The Title suggests little relevance to the topic		
Jane Broadbent	"A gender agenda"	2016	Meditari Accountancy Research	no	The Title suggests little relevance to the topic		
Passmore	The Solicitors Regulation Authority: looking to the future	2016	Legal Ethics	no	The Title suggests little relevance to the topic		

Amr Koth, Magdy Abdel-Kader, Amir Allam, Hussein Halabi & Ellie Franklin	Information technology in the British and Irish undergraduate accounting degrees	2019	Accounting Education	yes		yes	
Butler	Being appropriately professional: the interaction between professionalism, ICT and knowledge transfer	2016	New Technology, Work and Employment	no	To focused on a particular process not directly related to the impact of technology in accounting		
Timo Hyvönen, Janne Järvinen, Jukka Pellinen & Tapani Rahko	Institutional Logics, ICT and Stability of Management Accounting	2009	European Accounting Review	yes		yes	
Michela Arnaboldi, Yulia Sidorova & Giovanni Azzone	"Governing social media: the emergence of hybridised boundary objects"	2017	Accounting, Auditing & Accountability Journal	no	The Title suggests little relevance to the topic		
Luftman & Mclean	Key Issues for IT Executives	2004	MIS Quarterly Executive	yes		no	Although focusing on technological developments, accountants seem to be out of the picture
Bea Chiang & Jeffrey Limato	The Use of Technology in Tax Preparation: A Closer Examination of Electronic Filing and Filing Errors	2017	Corporate accounting and finance	no	To focused on a particular process		
Gisele Leite Padilha, Dannyella Costa Castro Moreira & Talyta Alves Rodrigues	Sped Fiscal: Impactos e Reflexos	2018	Revista Humanidades e Inovação	no	The Title suggests little relevance to the topic		
Edward Nartey	"Determinants of carbon management accounting adoption in Ghanaian firms"	2017	Meditari Accountancy Research	no	The Title suggests little relevance to the topic		
Mike Newman & Chris Westrup	Making ERPs work: accountants and the introduction of ERP systems	2005	European Journal of Information Systems	yes		yes	
Yusasniza Mohd Yunus, Mohd Zaher Mohd Zain & Aini Aman	Technological Mindfulness and Work-life Balance	2018	Journal of Accounting and Governance	no	The Title suggests little relevance to the topic		
Matthew Egan	Utilising Accounting and Accountants in the Management of Water Efficiency	2018	Australian Accounting Review	no	The Title suggests little relevance to the topic		
Christoph Endenich, Rouven Trapp & Michael Brandau	Management accounting networks in corporate processes – A cross-national study	2017	Journal of Accounting & Organizational Change	yes		no	Based on the different styles of management accounting and corporate decision-making, this research does not include technology innovation
Art Worster, Thomas R. Weirich & Frank Andera	Managing IT Change—Sales, Marketing, and Distribution	2016	Corporate accounting and finance	yes		yes	A Full Text Sift was conducted to evaluate the relevance of the study
Misha Pieters	International Code of Ethics for Professional Accountants: A Behind the Scenes Look at the eCode	2019	Australian Accounting Review	no	The Title suggests little relevance to the topic		
Heba El-Sayed Mayada Abd El-Aziz Youssef	Modes of mediation" for conceptualizing how different roles for accountants are made present	2015	Qualitative Research in Accounting & Management	yes		yes	
Elif Baykal & Cemal Zehir	Mediating effect of psychological capital on the relationship between spiritual leadership and performance	2018	Ekonomika a Management	no	The Title suggests little relevance to the topic		
Abdullah Ibrahim Alkrajji, Thomas Jackson & Ian Murray	Factors impacting the adoption decision of health data standards in tertiary healthcare organisations in Saudi Arabia	2016	Journal of Enterprise Information Management	no	The Title suggests little relevance to the topic		
Enrico Bracci Sue Llewellyn	Accounting and accountability in an Italian social care provider	2012	Accounting, Auditing & Accountability Journal	no	The Title suggests little relevance to the topic		
Prasanna Tambe Lorin M. Hitt	Now IT's Personal: Offshoring and the Shifting Skill Composition of the U.S. Information Technology Workforce	2012	Management Science	yes		no	The research relates new IT with skill composition of U.S. onshore IT workforce, not necessarily concerning the impacts of IT in the accounting area
Judy Brown Jesse Dillard	Integrated reporting: On the need for broadening out and opening up	2014	Accounting, Auditing & Accountability Journal	no	To focused on a particular process not directly related to the impact of technology in accounting		

Rafael Heinzelmann	Occupational identities of management accountants: The role of the IT system	2017	Journal of Applied Accounting Research	yes		yes	
Christensen, Wang & Ban Bever	Consulting on the Cusp of Disruption	2013	Competitive Strategy	no	The Title suggests little relevance to the topic		
Laura Girella Roberto Tizzano & Elisa Rita Ferrari	Concepts travelling across disciplinary fields: the case of the business model	2018	Springer Nature	no	The Title suggests little relevance to the topic		
Jani Taipaleenmäki & Seppo Ikaheimo	On the convergence of management accounting and financial accounting – the role of information technology in accounting change	2013	International Journal of Accounting Information systems	yes		No	Literature Review
Enrico Bracci, Christopher Humphrey, Jodie Moll Ileana & Steccolini	Public sector accounting, accountability and austerity: more than balancing the books?	2015	Accounting, Auditing & Accountability Journal	yes		no	The research is mainly focused on the impact of austerity policies on public sector accounting and accountability systems
Songqing Jin, Hengyun Ma, Jikun Huang, Ruifan Hu & Scott Rozelle	Productivity, efficiency and technical change: measuring the performance of China's transforming agriculture	2009	Springer Science	no	The Title suggests little relevance to the topic		
Daniel Botez	Recent Challenge for Auditors: Using Data Analytics in the Audit of the Financial Statements	2018	Broad Research in Artificial Intelligence and Neuroscience	yes		yes	A Full Text Sift was conducted to evaluate the relevance of the study
Marina Kirstein Rolien Kunz	Student-centred approach to teaching large classes: friend or foe?	2015	Meditari Accountancy Research	no	To focused on a particular process not directly related to the impact of technology in accounting		
Maja Korica & Eamonn Molloy	Making sense of professional identities: Stories of medical professionals and new technologies	2010	Human Relations	no	The Title suggests little relevance to the topic		
Steenkamp Nel	The adoption of XBRL in South Africa: an empirical study	2012	The Electronic Library	yes		no	The research is about the level of awareness of a new technology among accountants, not its impacts
David M. Brock	The changing professional organization: A review of competing archetypes	2006	International Journal of Management Reviews	yes		no	Literature Review
Mennicken	From inspection to auditing: Audit and markets as linked ecologies	2010	Accounting, Organizations and Society	no	To focused on a particular process not directly related to the impact of technology in accounting		
Ivica Pervan & Ivana Dropulić	The impact of integrated information systems on management accounting: Case of Croatia	2019	Management	yes		yes	
Thuy Duong Oesterreich & Frank Teuteberg	The role of business analytics in the controllers and management accountants' competence profiles	2019	Journal of Accounting and Organizational Change	yes		yes	
Ursula Plesner, Lise Justesen & Cecilie Glerup	The transformation of work in digitized public sector organizations	2018	Journal of Organizational Change Management	no	The Title suggests little relevance to the topic		
Neil Pollock Robin Williams	"Industry analysts – how to conceptualise the distinctive new forms of IT market expertise?"	2015	Accounting, Auditing & Accountability Journal	no	To focused on a particular process not directly related to the impact of technology in accounting		
Bruce A. Reinig, Gert-Jan de Vreede & Robert O. Briggs	An Investigation of the Yield Shift Theory of Satisfaction Using Field Data from the United States and the Netherlands	2017	Springer Science	no	The Title suggests little relevance to the topic		
Jodie Moll & Ogan Yigitbasioğlu	The role of internet-related technologies in shaping the work of accountants: New directions for accounting research	2019	The British Accounting Review	yes		yes	A Full Text Sift was conducted to evaluate the relevance of the study
Giedrė Večerskienė, Loreta Valančienė & Vytautas Bogušlauskas	Training Accounting Specialists at Kaunas University of Technology Economics and Management Faculty: Past, Present and Perspectives	2008	ENGINEERING ECONOMICS	yes		no	The research does not correlate new technologies with accounting or accountants
Keith Robson, Christopher Humphrey, Rihab Khalifa & Julian Jones	Transforming audit technologies: Business risk audit methodologies and the audit Weld	2007	Accounting, Organizations and Society	yes		yes	

Natalia Shmatko, Yuriy Katchanov & Galina Volkova	The value of PhD in the changing world of work: Traditional and alternative research careers	2020	Technological Forecasting & Social Change	no	The Title suggests little relevance to the topic		
Alexander Styhre	Institutionalizing technoscience: Post-genomic technologies and the case of systems biology	2011	Scandinavian Journal of Management	no	To focused on a particular process not directly related to the impact of technology in accounting		
Anna Samsonova-Taddei & Christopher Humphrey	Transnationalism and the transforming roles of professional accountancy bodies	2014	Accounting, Auditing & Accountability Journal	yes		no	The article focuses on the transnational policy arena and not in the relationship between accounting and technology
Robert Elliott	Twenty first centur assurance	2002	Auditing	yes		yes	A Full Text Sift was conducted to evaluate the relevance of the study
Yuan-Hui Tsai, Chieh-Peng Lin, Hwa-Chun Ma b & Rong-Tsu Wang	Modeling corporate social performance and job pursuit intention: Forecasting the job change of professionals in technology industry	2015	Technological Forecasting & Social Change	no	To focused on a particular process not directly related to the impact of technology in accounting		
Chiara Valentini, Dean Kruckeberg & Kenneth Starck	Public relations and community: A persistent covenant	2012	Public Relations Review	no	The Title suggests little relevance to the topic		
Kimberly D. Westermann, Jean C. Bedard & Christine E. Earley	Learning the “Craft” of Auditing: A Dynamic View of Auditors’ On-the-Job Learning	2015	Contemporary Accounting Research	no	To focused on a particular process not directly related to the impact of technology in accounting		
Sara Wilkinson, Dulani Halvitiigala & Hera Antoniadis	Educators, professional bodies and the future of the valuation profession	2018	Property Management	no	To focused on a particular process not directly related to the impact of technology in accounting		
Timothy Yeardley	Training of new managers: why are we kidding ourselves?	2017	Industrial and Commercial Training	yes		no	The main topic of interest of this research are soft skills, the implications of technology considered in the article are focused mainly in personal relations, not the main focus of the dissertation