Modern day Management Accountants: A latent Dirichlet allocation investigation

Francesca Culasso[*], *Elisa Giacosa*[*], *Edoardo Crocco*[*], *Daniele Giordino*[*]

Received: 30 June 2022
Accepted: 25 May 2023

Abstract

The emergence of computerized information systems has provided management accountants with an unprecedented array of possibilities when it comes to data analysis. Nevertheless, it has progressively changed the profession as we know it. Thus, a need for research to clearly define the modern management accountant profile in terms of skills and tasks expected by their employers has been echoed by several authors. Our study draws on a set of 841 job postings featuring management accounting positions across Europe to define a set of critical competencies and tasks of modern-day accountants. Topic modeling is applied to the dataset to identify and extract the information needed to answer the research question. From a theoretical standpoint, the proposed contribution strives to fill in multiple research gaps in accounting literature, namely the incidence of reporting in a management accountant's daily schedule, the gap between employers' expectations and current accounting education programs, and the importance of IT literacy. From a practical perspective, the study provides management accountants with an extensive overview of the competencies and tasks they are expected to perform. Additionally, our empirical evidence informs educators, and policymakers with an insight into today's job market to use as a potential benchmark for their educational and professional programs.

Keywords: Management Accounting, Latent Dirichlet Allocation, Skills, Tasks, Job Descriptions

[*] University of Torino, Department of Management. Corresponding author: edoardo.crocco@unito.it.

Management Control (ISSN 2239-0391, ISSNe 2239-4397), 2023, 2 – Special Issue
Doi: 10.3280/MACO2023-002-S1-002

1. Introduction

Accounting has a rich history and traditions, yet it has experienced several changes throughout the decades. According to Littleton (1928), since 1494, when the bookkeeper's first printed book appeared, the underlying principles of accounting based on double-entry are supposedly not subject to change due to their fundamental nature. However, in today's landscape, the combination of technology and innovation has drastically changed the accounting profession and will continue to do so for the foreseeable future. While the accounting world is complex and rapidly changing (Lombardi, 2021), the significant challenges accountants face are as follows: evolving innovative and digital technology, continued globalization of reporting/disclosure standards, and new forms of regulation.

The same changes apply to management accounting, generally referred to as a branch of accounting that generates and delivers information to the internal decision-makers of an organization (Anthony, 1965; Macintosh, 1985). Management accounting relies heavily on information and data (Oppi & Vagnoni, 2020; Wolf *et al*., 2020). Management accountants help business operations by, among other tasks, gaining information on costs to prepare internal financial reports and records and support managers' decision-making process in achieving business goals (Richardson *et al*., 2015; Sorensen, 2009). Due to its data-dependent nature, management accounting is inevitably affected by the rapidly changing technological landscape. For instance, modern management accountants should handle big data from their information management systems and help top management translate that data into clear and rational strategic decisions (Wadan *et al*., 2019).

The paper aims to investigate the current literature and its trends in the management accounting profession. The work environment of management accountants has drastically changed over recent years, as modern technology has disrupted both the tasks required of accounting professionals and, subsequently, the skill set required by employers worldwide. While the body of literature on IT capabilities is growing concomitant with the one on digital transformation (Munir *et al*., 2022), it is still unclear what exactly is required from modern management accountants in terms of tasks and skills (Pilipczuk, 2020). Given the importance of management accounting in current times and the need for companies and professionals to better understand the complex job market they operate in, the research questions (RQ) driving this study are therefore twofold:

RQ1: What capabilities are required by organizations for management accountants?
RQ2: What are modern management accountants' tasks in their organizations?

Finding an answer to the above questions is vital to ascertain the current state of management accounting as a profession. Additionally, by answering the two questions above, we could effectively profile the current job market for management accountants, which would provide valuable insights to both companies and practitioners.

Our study draws on 841 job postings featuring management accounting positions across Europe to define a set of critical competencies and tasks of modern-day accountants. First, the vast dataset was scraped from major job postings outlets. Subsequently, topic modeling will be applied to the dataset to identify and extract the information needed to answer the research question. More specifically, the authors propose the use of latent Dirichlet allocation, which is a Bayesian statistics-based algorithm for topic modeling. Through latent Dirichlet allocation (LDA), the authors aim to extract information on competencies and tasks required from modern-day, newly appointed management accountants across the globe. Via topic modeling, it will be possible to clearly define the universal profile of the modern-day management accountant more extensively and comprehensively than through qualitative approaches. In addition, it will also be possible to highlight the emerging differences across countries in how each of the dimensions is distributed.

The study comes with several implications for both theory and practice. From a theoretical standpoint, the proposed contribution strives to fill in multiple research gaps in accounting literature, namely the evolution of management accounting as a profession and the modern competencies and skills required by today's management accountants. From a practical perspective, the study aims to profile the modern management accounting profession, which is helpful for practitioners to both identify current market demands and opt for proper skill development actions to meet modern requirements.

The paper is organized as follows. In the next section, we examine the evolving role of management accountants to highlight modern challenges, the impact of digital transformation, and their role in tasks and critical competencies. Further, we delineate the gap in knowledge regarding the skills required from today's management accountants and the current job market's expectations of them. In the third section, we describe the research design chosen for the study and the rigorous step-by-step process required by LDA

topic modeling. Subsequently, we present the results of our analysis, divided into skills and tasks for clarity. Finally, we discuss the results of our study, draw conclusions, and suggest implications for research and practice.

2. Literature Review

2.1 The evolution of Management Accounting

Historically, management accountants have progressively evolved from being central to enacting management control in organizations (Anthony, 1965; Macintosh, 1985) to, more recently, broadening their range of action to accommodate strategic perspectives (Simons, 1995). In other words, management accountants have progressively become more involved in decision-making over the decades, integrating financial and non-financial information on operational and strategic levels (Byrne & Pierce, 2007). Thus, they have often been referred to as moving away from the traditional "bean counter" image toward a "business partner" of the management (Richardson *et al*., 2015; Sorensen, 2009). Today, scholars agree that management accountants hold a significant strategic role in companies (Magnacca & Giannetti, 2023), as they act as the organizational conjunction of pure accounting and strategic consulting. However, some recent developments have started to question the "business partner" nature, investigating the dilemma as to how a business partner role can be enacted when management accountants find themselves between independence and involvement (Tillema *et al*., 2022).

According to the Institute of Management Accountants (IMA) (2008), management accounting "[...] involves partnering in management decision making, devising planning and performance management systems, and providing expertise in financial reporting and control to assist management in the formulation and implementation of an organization's strategy." Additionally, in some European countries, management accountants are labeled as "controllers" and the interchangeable use of the two terms is commonly found in the literature as well (Chiucchi & Gatti, 2015). Definitions and labels aside, the management accountant's identity is far from universally agreed upon and is the object of academic debate today (Oppi & Vagnoni, 2020; Wolf *et al*., 2020). In addition to what has been discussed in the previous paragraph, the scientific debate has seen the role of management accountants progressively change to embrace their business partners nature (Byrne & Pierce, 2007; IMA, 2008; CIMA, 2018), as well as a more recent, decentralized, 'hybrid' role (Hoozée & Mitchell, 2017). Decentralization, in

particular, sees management accountants working directly for or with individual managers, for the sake of enhancing their sensitivity to managers' information needs.

Furthermore, in today's hyper-competitive world, the field of management accounting is constantly evolving, and there is an increasing interest in the description of current and future models of management accountant skills. This interest is due to the extensive and radical changes caused by the digital transformation of businesses worldwide that have led to a more strategic and integrated role of management accounting, as accountants are now more than ever expected to partake in the strategic decision making process of their companies (Magnacca *et al.*, 2023; Tillema *et al*., 2022). Thus far, academic literature has extensively focused on the changing role of information technologies for management accountants. Therefore, the above perspective is helpful when trying to profile management accountants' past, present, and future roles, along with the implications of digital transformation for management accounting.

Digital transformation is a complex and pervasive phenomenon, driven by both the adoption of disruptive technologies and the adoption of said technologies in the organizational workflow (Heinzelmann, 2019). We mentioned digital transformation being pervasive because 'no aspect of business today remains untouched by digital technologies.' (Bhimani & Willcocks, 2014). Hence, much like all the functional areas, modern accounting is actively influenced by these transformations. A few specific literature gaps remain, however, despite the growing relevance and consequent levels of scientific output found in management accounting research (Cavélius *et al*., 2020). The first question remaining partially unanswered has to do with a growing public awareness for corporate sustainability among companies, resulting in management accountants integrating sustainability assessments in their usual tasks (Cheffi *et al*., 2021; Jusoh *et al*., 2021). The second research direction is tied to the increasingly relevant role of information technologies in management accounting, which requires professionals to adjust their skill sets regularly to keep up with the fast-changing environment (Oppi & Vagnoni, 2020; Wolf *et al*., 2020).

Both themes spark the debate on the challenges faced by modern-day accountants, as they are simultaneously required to redefine their role as the coordinators of processes for the management of sustainability information and learn how to work with technology (Paulsson, 2012). The above is true, for instance, regarding the role of business intelligence and big data reporting in Enterprise Resource Planning systems. In other words, when questioned about the future of management accounting as a profession, scholars agree

that they emphasize the increasing role of information technologies and the importance of interpersonal (Jakobsen *et al*., 2019) and technical skills development (Goretzki & Strauss, 2017). Additionally, the authors seem to agree that future management accountants will be asked to coordinate in managing sustainability information (Cheffi *et al*., 2021; Jusoh *et al*., 2021). The above trend and the increasing role of reporting in managerial accounting pave the way for a future in which sustainability reporting and predictive accounting will play a significant role (Ascani *et al*., 2021; Schaltegger *et al*., 2017).

In the above described climate of uncertainty, turbulence and digital disruption, several calls have been made to understand management accountants' multiple identities and identity conflicts (Wolf *et al*., 2020). However, to this day, a clear, universal depiction of what a management accountant is and what they are expected to do is still somewhat missing (Oppi & Vagnoni, 2020), or limited to few exploratory studies on limited samples (Budding *et al*., 2022; Siriwardane *et al*., 2015). The study of ten Rouwelaar *et al*. (2021), for instance, calls for researchers to expand upon their preliminary findings by analyzing a more general population of management accountants, possibly across multiple countries.

2.2 Modern-Day Management Accountants in terms of Skills and Tasks

In today's ever-changing digital environment, it is important for management accountants to continuously develop their technical skills to keep up with technological advancements, all the while possessing a multifaceted professional identity composed of both hard and soft skills. The Global Management Accounting Principles published by the Chartered Institute of Management Accountants (CIMA) (2018), identifies strategic thinking, communication, and digital literacy as critical competencies for management accountants to possess. The study of Brown & Cooper (2019) corroborates the need for modern-day management accountants to possess a varied set of skills, including emotional intelligence, adaptability, and problem-solving skills. More recently, Ott (2022) stressed the need for management accountants to possess strong analytical thinking, more than what is required from financial accountants.

Additionally, Webb (2020) noted that while today's management accountants are well versed in older digital technologies such as spreadsheets, they find the relatively newer technological issues such as blockchain and coding somewhat challenging, despite their obvious potential for accounting

practice. This area of research has great potential for accounting practice, as modern technology can actively enhance decision-making for competitive performance and cultivate business values that enhance innovation performance (Mikalef *et al*., 2019). Lawson *et al*. (2014) goes as far as to say management accountants in today's era act as a bridge between data scientists, analysts, and business executives. To expand upon this notion, data scientists possess significant technical knowledge, yet often lack understanding of contextual business factors surrounding the data (Wadan *et al*., 2019). On the other end of the spectrum, business executives may not fully understand the true potential of data analytics. In the context above, management accountants can act as a bridge between these two business functions. They can simultaneously interpret and analyze data, highlighting its implications for managerial decision making (Král *et al*., 2021; Paulsson, 2012).

Still on IT literacy, previous studies have unveiled the general importance of electronic spreadsheet skills in management accounting (Bradbard *et al*., 2014). For instance, Rai *et al*. (2010) rated spreadsheet skills as the second most important IT skill for a management accountant to possess out of 30. Similarly, Beaman and Richardson (2007) highlighted how spreadsheets were deemed the most important skills for accountants tasked with helping management with operative decision making. Additionally, literature on management accounting education has focused on the importance of communication skills, especially in educating future management accountants as business partners rather than bean counters (Jakobsen *et al*., 2019). Previous studies have revealed how communication skills are a close second to intellectual skills when analyzing what it takes to become a management accountant (Hung *et al*., 2019). The above results are backed by empirical evidence, such as the study conducted by Spraakman *et al*. (2015). They emphasized the importance of Microsoft tools proficiency for newly appointed management accountants, with the Excel spreadsheet tool deemed the most important in their skill set.

In addition to a solid IT background for management accountants, a lively academic debate has developed around communication skills. Siriwardane *et al*. (2015) tackled the topic with a critical perspective, as they highlighted the mismatch between the level of communication skills expected by the employers and the supposed lack of communication specific training in accounting education programs. The same issue was brought back into academic light by Webb & Chaffer (2016), who criticized accounting educators for not stressing the importance of generic soft skills, communication included. Same sentiment has been echoed by previous researchers and has been the

center of attention for a decades long debate, which is still ongoing (Bui & Porter, 2010; Jackling & de Lange, 2009; Kavanagh & Drennan, 2008).

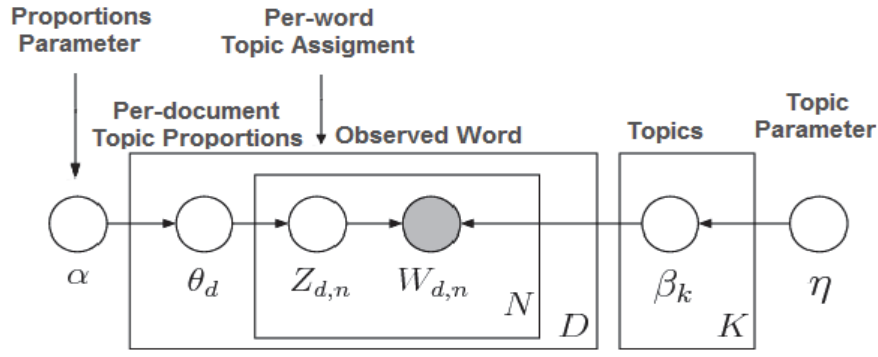
Granted that the management accountant's identity is evolving, especially in the dawn of digital transformation and Industry 4.0 (Oppi & Vagnoni, 2020; Wolf *et al*., 2020), researchers have yet to find a universal agreement of what a management accountant is expected to do and to be in modern times. Siriwardane *et al*. (2015), for instance, called for larger empirical datasets to better frame the topic.

3. Methodology

LDA topic modeling is at the core of the present study's research design, as it allows the processing of significant amounts of data from textual documents. Topic modeling is a statistical model for discovering hidden semantic assemblies in textual data. Advances in computational social science have expanded researchers' ability to extract information from online sources. Accounting scholars are increasingly taking advantage of these methods (Culasso *et al*., 2023; Nielsen, 2022), as the tools allow for a clear, transparent, and replicable way to extract information from large volumes of data. More specifically, natural language processing (NLP) has been successfully applied in analyzing a wide range of data, including social media content, websites, and collections of textual documents.

While NLP is increasingly common in social science research, LDA has been underutilized, despite its advantages compared to other NLP approaches. The LDA algorithm is based on Bayesian statistics principles and extracts topics or themes from documents based on the co-occurrence of text. In other words, the premise of LDA is that a collection of distinct and unique textual documents feature a shared set of topics that are distributed heterogeneously throughout the sample. Co-occurrence of words is used to discern and extract topics. LDA is the best fit for the present study's research design because it treats documents as containing varying proportions of topics. Thus, a single text may be 30 percent of one topic, 10 percent of another, and 60 percent of a third topic. Thus, when applied to a corpora of several job postings, the LDA algorithm effectively identifies the multitude of organizational capabilities and individual skills mentioned. Figure 1 provides a visual representation of how the LDA algorithm works.

Fig. 1 - Latent Dirichlet Allocation algorithm



More specifically, three characteristics of LDA highlight its advantages for studying modern management accounting job postings compared to other methods. First, LDA does not impose a predefined coding structure on text and extracts topics inductively based on word frequencies and co-occurrences. In other words, unlike many forms of sentiment analysis, LDA features a free-form approach to textual documents, with no preconstructed coding structures. Second, LDA allows for measuring the multidimensionality of topics by highlighting the varying degrees each topic contributes to the documents included in the sample. Multidimensionality is critical in management accounting research, as previous research has highlighted modern accounting professionals' multifaceted nature in terms of tasks and skill sets. Additionally, LDA allows for comparative cross-cultural analyses by separating data from each nation into distinct documents, comparing the topic distribution in each country/document and highlighting emerging differences among them. Finally, LDA also retains many strengths of NLP more generally, such as focusing on texts as valid conveyors of modern accounting themes and the capability to analyze a large amount of data from multiple online sources, as opposed to focusing on single case studies or qualitative interviews.

3.1. Source and Pre-Process Text Data

Given the inductive nature of LDA, particular care should be taken when selecting a corpus of text that conveys the information we look for. For this purpose, job postings from major job search sites were used. Job postings have been extensively used as a source of data for business and social science research (Ge *et al*., 2022), due to them featuring extensive depictions of the

core competences required along with the list of tasks expected to be performed by the newly appointed candidate, therefore making them a valuable source of information in regards to our original research questions. Furthermore, these descriptions are intended to be accurate, since companies are interested in finding specific profiles to suit their needs. The data was further pre-processed for analysis using MATLAB. The textual corpus was then processed. First, we performed tokenization, which consists in segmenting a document into its atomic elements. In our case, we tokenise our sample to words, thus removing any other element from the set of data we have gathered. Subsequently, stopwords were removed from the corpus as well. The definition of stopword is flexible, yet it generally includes words that are meaningless to a topic model. For instance, conjunctions such as "for" or "and" do not add any relevant meaning to the model, thus it is best to remove them from the token list.

Data was collected from several job posting sites, namely LinkedIn, Indeed and Glassdoor. We integrated the dataset with job postings found via Google and featured directly on the company website. We specifically looked for postings featuring "management accountant." In the case of a low amount of records retrieved ($n < 20$), we integrated the search with the local language equivalent. For instance, in the case of Sweden we integrated the sample with records found using "förvaltningsrevisor," accurately translated with the help of professionals. During the above described phase, we paid particular attention to duplicates and removed them when found, as companies tend to post the same description on multiple platforms to broaden their reach. Additionally, drawing on Papoutsoglou *et al.* (2022), we performed an extensive, qualitative review of each job description in order to filter out job descriptions not fitting the scope of our research. We set a first exclusion criteria, namely the brevity of the job description itself when totalling less than 150 words. Additionally, we filtered out job descriptions purely consisting of bullet points, as LDA topic modeling performs best when mining long-form text. Finally, we proceeded with the removal of job descriptions not fitting with the conceptual scope of what a management accountant is, according to our literature review. This step was deemed necessary due to the varied terminology used in management accounting job postings, occasionally referred to as "control" or "controller". The final corpus included 841 job postings from 10 different European countries. Table 1 summarizes the process, with the details on how many records were extracted from each source. We note that Glassdoor and Google are both to be considered in the "Others" section.

Table 1 - Job Postings from each source

	UK	FR	GER	IT	DK	NL	NW	SW	SP	SD
Indeed	1271	65	280	121	72	189	67	74	136	301
LinkedIn	1091	36	301	89	156	321	57	405	72	194
Others	151	20	15	12	8	21	15	12	10	17
Duplicates	597	34	180	75	65	156	40	63	51	162
Qualitative Filter	1460	30	346	147	171	375	99	428	167	350
Total	456	57	70	55	54	16	27	61	44	21

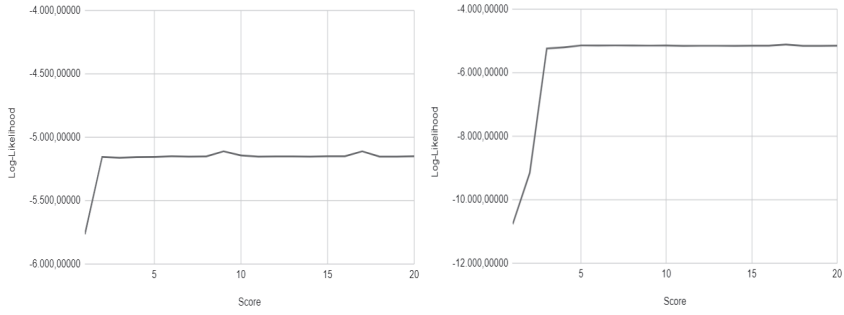
Once we achieved a general agreement on the overall sample, we divided the data into two distinct subsamples, one featuring the competences and another featuring the tasks to be performed. With the corpus of job postings, LDA was used to identify dominant dimensions in terms of skills and tasks. In order to identify the ideal number of topics to be extracted from the two corpora, model fit statistics were compared across several LDA models with varying topics. While a more complete overview of the model fit statistics can be found below, probabilistic coherence score was used to determine the model selection, as it is generally considered the most efficient way to represent the interpretability of topics. Coherence is calculated on the difference between the probability of a set of words occurring together in a topic and their probability of occurring in the full corpus. In other words, models with a high coherence score feature a low degree of shared words between topics, thus making each topic as distinct as possible. Figure 2 reports the coherence score for each corpus using 1 through 20 topics. Regarding the skills corpus, the ideal model featured 4 topics, as after the 5th topic is added improvements are less substantial and inconsistent. Similarly, a 3 topics model was deemed the most fit for the tasks' corpus.

Topic coherence (Fig. A1) was deemed the most useful statistic to consider because it best represents the interpretability of topics. Log-likelihood test was also conducted in order to further validate the choice. As depicted

in figure 2, featuring the log-likelihood of individual words being found in the assigned topic, we find diminishing returns to model fit beyond the models chosen for the study.

Fig. 2 - Topic Coherence Scores

Fig. 3 - Log-likelihood Scores



4. Findings

4.1. LDA Topics

The authors took two steps to optimize the data extraction process and validate the results. First, they ran model fit statistics to determine the ideal dimensions for both corpora. Second, they performed semantic analysis via Leximancer on both samples and compared the results with the ones obtained from LDA topic modeling for consistency. Leximancer allows to perform

both semantic (relational) and thematic (conceptual) analysis of the data, through two stages of nonlinear machine learning. Its approach differs from traditional LDA topic modeling, as there is no focus on the relationship between documents, rather purely on the themes and concepts featured in them. Thus, Leximancer is a valid tool to perform a distinct analysis and validate the results obtained through LDA topic modeling, as a control methodology of some sort. We discussed model fit statistics earlier when Figure 3 was presented. It is important to note that topic meaning should be left to qualitative interpretation based on the words featured in each topic and their overall distribution (Schouten & Frasincar, 2016). Since LDA generates topics based on co-occurrences, rather than emphasizing individual items, it is up to the authors to label each dimension with a term they deem the most appropriate. Asmussen and Møller (2019) point out that the labeling of topics is highly subjective and left to the researchers' discretion. To minimize subjectivity biases and provide the strongest theoretical base possible to extract data, they suggest reviewing the most frequent words for each topic and a title review to lower the risk of incorrectly labeling topics. In doing so, using a theoretical framework to guide the interpretation of data is highly recommended. Thus, we used the framework elaborated by Lawson *et al*. (2014) to extract and label the dimensions in the most theoretically sound way possible.

4.2. Management Accountants' Skills

Four distinct topics have been identified among the skills corpus, each corresponding to an individual trait that characterizes the ideal management accountant profile. Figure 4 features the most common word stems for each dimension, ranked in order of probability of each word stem being found in a topic and are sorted with highly weighted words located at the top of each list.

Fig. 4 - Words distribution among the skills corpus

Topic 1	Topic 2	Topic 3	Topic 4
Skills	Software	Local	Learn
Working	Experience	Tasks	Fluent
Work	Knowledge	GAAP	Knowledge
Experience	Excel	IFRS	Solid
Management	Years	Completion	Staff
Finance	Good	Excel	Independently
Ability	Professional	Controller	Talk
Strong	MS (Microsoft)	VAT	Concepts
Team	Programming	Group	Communicate
Role	Fluent	Returns	Social
Degree	Training	Tables	Speaker
Financial	German	Department	Best
Excellent	Office	Function	Number
International	English	Accurate	Banks
Seniority	**IT Skills**	**Technical Skills**	**Interpersonal Skills**

4.2.1 Seniority

Words most frequent in the Seniority dimension include a collection of items pertaining to career advancements ("Experience", "Ability", "Strong"), along with words relating to excellence standards required for such positions ("Excellent", "Degree" and "International"). Examining the distribution of this dimension across countries, reveals that oftentimes a minimum of 2 years of experience is required, while 5 years of experience seems to be preferred. Overall, when ranking the dimensions by their numerical dominance in the corpus, we find Seniority to be the most prominent one. This result is somewhat to be expected, due to the non-entry-level nature of most management accounting positions, that instead require significant work experience and relevant education.

4.2.2. IT Skills

The next topic contains high frequencies of words related to knowledge of IT systems, particularly the Microsoft Office suite ("MS," "Office," and "Excel"). Strong knowledge of Microsoft Excel, as expected, is essential for modern management accountants, yet what is interesting about this dimension is the presence of word stems concerning specific accounting software,

as well as basic programming skills ("Software" and "Programming"). Again, Oracle, Epicor, and SAP are the most often cited tools for accounting suites, with a few companies going as far as to mention their proprietary software solutions. Notably, the IT skills dimension is somewhat relevant regarding numerical dominance in the corpus, being the second most dominant topic. While this result is not interpreted as IT skills being more relevant than accounting and business skills, it is still representative of the importance of IT background in modern-day management accounting professionals.

4.2.3. Technical Skills

The "Technical Skills" dimension shares some similarities with the "Seniority" dimension, most notably regarding accounting and business knowledge. What differentiates the two is the emphasis on the temporal perspective seen in the "Seniority" dimension, which stresses the importance of multiple years of experience, whereas "Technical Skills" focuses on the accounting-specific knowledge required from the position ("GAAP," "IFRS," "Returns" and "VAT"). An interesting peculiarity of this perspective is the lack of references to sustainability and sustainability reporting, thus suggesting that management accountants are not expected to possess their specific know-how. On the contrary, deep knowledge of national and international accounting standards appears to be necessary.

4.2.4. Interpersonal Skills

The "Interpersonal Skills" dimension has high frequencies of word stems related to the interaction with co-workers. Being able to communicate effectively with people around them appears to be highly valuable for management accountants ("Fluent," "Communicate," "Talk," and "Speaker"). This result corroborates the dialogic nature of the position, often required to act as a bridge between the accounting department and decision-makers among the top management. Most companies stress the need for management accountants to possess excellent communication skills and be team players.

4.3. Management Accountants' Tasks

Three distinct topics have emerged from the analysis of management accountants' tasks. Figure 5 features the most common word stems for each dimension, ranked in order of probability of each word stem being found in a topic and sorted with highly weighted words at the top of each list.

Fig. 5 - Words distribution among the tasks corpus

Topic 1	Topic 2	Topic 3
Reporting	Management	Support
Accounts	Finance	Ensure
Financial	Role	Ensuring
Accounting	Team	Group
Business	Business	Role
Monthly	Technology	Projects
Management	Pivotal	Monitor
Preparation	Providing	Company
Analysis	Key	Improvement
Payment	Duties	Review
Tax	Journals	Expected
Support	Holders	Accurate
Ensure	Centre	Proposal
Reporting	**Business**	**Monitor**

4.3.1 Reporting

The most numerically dominant dimension of the tasks' corpus concerns reporting, and processes associated with it ("Reporting," "Analysis," "Monthly," and "Preparation"). In the same dimension, we find word stems related to management accounting ("Accounting," "Accounts," and "Management"), thus implying a solid linkage between accounting and reporting, as noted earlier throughout our literature review. It is important to note that occasionally job descriptions use the term "reporting" to depict the professional figure management accountants are expected to refer to, not actual reporting tasks. For instance, a job posting reads: "Management Accountants are expected to report to the Chief Financial Officer…". The above represents a limitation of LDA as an algorithm: the method cannot discern the

context within which words are used, only their frequencies with other words. Despite this limitation, a manual review of the sample corroborates the relevance and validity of reporting as a dimension.

4.3.2 Business

The second dimension of numerical dominance is connected to management accountants' "Business Partner" nature. In other words, the dimension depicts the management accountant as a strategist who can provide strategic advice to top management and influence their decisions ("Business," "Pivotal," and "Management"). Several job descriptions cite the term "Business Partner" literally, further testifying to the evolving role of management accountants. An exciting result within this dimension is the strong presence of the "Technology" word stems, signaling an ever-growing interest in opportunities stemming from digital technologies and digital transformation. While management accountants are hardly the sole ones responsible for a company's strategic direction, our empirical examination strongly reinforces their role as business partners and, more broadly, carriers of strategic business knowledge.

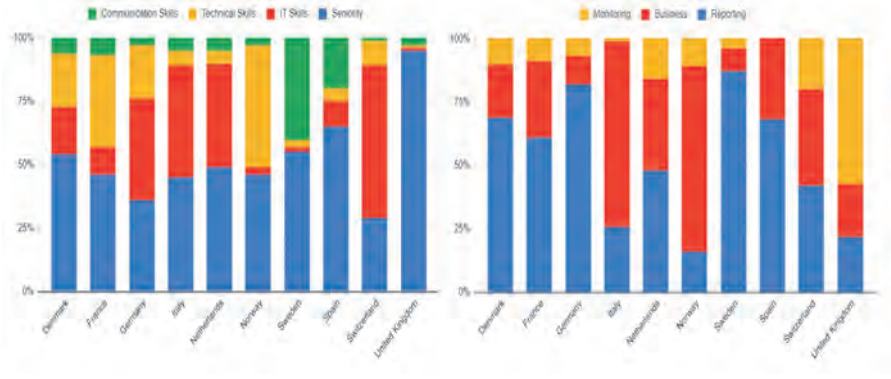
4.3.3 Monitor

Monitoring can be defined as an ongoing process, usually directed by management, to ensure processes are working as intended. At the same time, it does share some common ground with the "Reporting" dimension; the fundamental difference between the two lies in their temporal perspective. Among the "Monitor" dimension, we find word stems stressing the responsibility of management accountants, often asked to make specific processes go as planned ("Monitor," "Projects," and "Expected"). What is interesting about this dimension is the proactive nature of management accountants as they do not limit themselves to the monitoring of processes and instead play a somewhat coordinating role in making sure multiple actors and activities are carried out correctly ("Support," "Ensure," "Ensuring" and "Group"). Furthermore, we often find the words "Ensure" and "Ensuring" near words related to deadlines and time constraints, signaling the need for management accountants to guarantee the efficiency and timely delivery of the processes they are appointed to monitor.

4.4 Geographical Distribution of the Topics featured in the sample

LDA allows cross-cultural dataset analysis by dividing the sample into several separate documents, each belonging to a different country. In other words, the algorithm uncovers the distribution of each topic in correlation to the country they belong to, thus making comparisons between nations possible. Figure 6 illustrates the results by showing the percentage of each dimension from a cross-country perspective.

Fig. 6 - Distribution of skills and tasks dimensions by country



While the present study is not primarily designed to explain the discrepancies between countries in terms of tasks and skills, Figure 6 sheds light on the somewhat multifaceted nature of management accountants across Europe, further corroborating the hybrid nature of the profession as depicted in previous literature. In other words, Figure 6 evidences the fact management accountants are tailored around their employers' needs, with a consequent variety in skills and tasks (Byrne & Pierce, 2007; IMA, 2008; CIMA, 2018). Currently, there is no scientific evidence that could aid us in theoretically interpreting Figure 6, aside from the assumption that country-specific developments in management accounting have possibly led to differences in theory and practice (Thaller et al., 2023). In other words, we cannot safely assume cultural reasons as to why the required skills would significantly differ from country to country. Thus, Figure 6 should be read as a prompt for future research to expand upon, granted its exploratory nature due to the lack of scientific evidence. Future studies could possibly adopt a cross-cultural approach meant to delve deeper into country-specific developments and the differences they might have caused, if any.

5. Discussion

Over the years, management accounting as a profession has evolved, thus prompting a continued change in the skills required from newly appointed management accountants and the tasks companies expect them to perform (Cavélius *et al*., 2020). Moreover, in a world now driven by digital technology, the role of the management accountant has changed significantly to incorporate not only technical accounting competence but the ability to also understand the implications of digital transformation for business (Munir *et al*., 2022). While the disruptive changes brought about by digital technology continue to reshape the global job market, several studies have highlighted the need for research to unveil the current nature of management accountants to understand better how the role has evolved and, consequently, how the future of the profession will be shaped (Cavélius *et al*., 2020).

To achieve this goal, drawing on previous research on management accountants as a theoretical foundation for the study, we used machine learning techniques to collect and analyze job postings from all over Europe. Several themes have emerged from the analysis, both in terms of competencies and tasks to be performed. Moreover, the emerging themes have allowed us to depict a universal and updated archetype of the management accountant role, thus, bridging several gaps that remained unexplored by previous research (van der Steen, 2022).

We first unveiled the IT competencies needed for management accounting positions. Consistently with previous research, we highlight the use of business intelligence software to create customized reports, spreadsheet functions, and flowcharts using specialized software tools (Pilipczuk, 2020). Additionally, we find management accounting professionals to be more users of IT than their creators, thus being expected to possess proficiency in a vast array of tools and suites rather than overseeing their implementation or development (Král *et al*., 2021).

We further contribute to the endless debate on the bean counter and business partner roles of management accountants (Paulsson, 2012; Král *et al*., 2021; Carlsson-Wall *et al*., 2022) by unveiling the hybrid nature of today's role that requires a broader set of knowledge and skills than traditional accounting positions. More specifically, we note the need for management accountants' soft skills, such as oral and written communication, to work in mixed teams with managers and specialists (Paulsson, 2012). This result not only contributes to the already existing scientific debate on management accounting (Král *et al*., 2021; Carlsson-Wall *et al*., 2022) but also expands upon recent exploratory research that delves into the hybrid nature of the position

(Budding *et al*., 2022; ten Rouwelaar *et al*., 2021) and answers the call for a clearer depiction of its identity (van der Steen, 2022).

Additionally, we find the increasing role of reporting in managerial accounting positions consistent with a recently developed stream of research investigating the topic (Bhimani, 2020; Nita, 2016; Schaltegger *et al*., 2017). Today's management accountants are expected to be able to timely prepare reports and communicate them effectively with people around them. Surprisingly enough, however, we find a minimal presence of sustainability-related word stems in the sample, thus suggesting that companies are not actively looking for sustainability reporting-specific competencies. This finding somewhat contradicts extant research (Ascani *et al*., 2021), and it is worth exploring further, possibly determining whether companies prioritize ad-hoc sustainability "experts" or, more simply, take these competencies for granted when appointing a management accountant.

In conclusion, we address RQ1 and RQ2 as follows. Regarding RQ1, we have identified several critical competencies from newly appointed management accountants. We find a hybrid blend of seniority, core accounting competencies, IT literacy, and communication skills. While accounting literacy can be considered a somewhat expected result, the numerical significance shown in the IT and communication skills dimensions unveils the need for management accountants to diversify their skillsets accordingly. This result bridges several gaps in the extant literature. It acts as an empirical follow-up for a few exploratory studies with limited sample size, but the results are consistent with ours.

Regarding RQ2, our study identified a series of recurrent tasks to be performed by today's management accountants (Byrne & Pierce, 2007). First, we find management accountants to be a hybrid blend of "bean counters" and "business partners," as they are expected to not only keep up with the information inflow in a timely and efficient manner but also to interpret the data and proactively communicate their conclusions to management (Richardson *et al*., 2015; Sorensen, 2009). We find an increasing need for management accountants to curate reporting, although we find little to no evidence on sustainability reporting precisely (Wolf *et al*., 2020). Finally, we find several references to digital transformation amid the "Business" dimension of management accountants' tasks. The above implies that digital transformation has changed the entry requirements for management accounting positions and influenced their "business partners" nature. In other words, management accountants are now expected to look into the chances created by digital technologies and how future business avenues could potentially explore them (Chiucchi & Gatti, 2015).

6. Conclusions, Implications and Future Research Directions

In conclusion, our empirical findings unveil the multifaceted nature of the modern management accountant profession. From a task perspective, we witness management accountants shifting towards a blended role between data analysts and traditional accountants (Richardson *et al*., 2015; Sorensen, 2009). They are asked to oversee, report, be accountable, and effectively communicate information to people around them (Hung *et al*., 2019). Consequently, the skills required from modern management accountants mirror the multifaceted nature of their role, as they need to possess a hybrid mixture of IT skills (Bradbard *et al*., 2014; Rai *et al*., 2010), accounting-specific knowledge, and interpersonal skills to tie it all together (Jakobsen *et al*., 2019).

Our research makes several contributions to the literature, both theoretical and practical. First, from a theoretical perspective, our study complements the literature that examines what management accountants do by unveiling a snapshot of the current job marketplace. In doing so, we complement the literature that examines what management accountants do by enriching actual exploratory knowledge with a large dataset of empirical evidence from multiple countries (Bui & Porter, 2010; Jackling & de Lange, 2009; Kavanagh & Drennan, 2008). Results reinforce the multifaceted nature of modern management accounting jobs and their role as coordinators of processes for the management of information (Oppi & Vagnoni, 2020; Wolf *et al*., 2020). Second, we shed light on the professional skills expected from newly appointed management accountants by illustrating the importance of a tripartite blend of pure accounting, IT, and communication skills, along with solid seniority often required for top management positions where a significant level of responsibility and decision-making is involved (Král *et al*., 2021; Paulsson, 2012). Finally, our results speak to the literature on accounting and digital transformation by unveiling how the former is influenced by the latter in terms of specific skill requirements in the modern workplace (Goretzki & Strauss, 2017).

Additionally, our study features several practical implications. One implication is that organizations can now more effectively approach the job marketplace when it comes to recruiting management accountants, as they now have a better understanding of the ideal modern profile for the profession (Hung *et al*., 2019). Similarly, organizations could invest in reskilling already appointed management accountants to meet the skill set required for the modern workplace. The above applies to potential future candidates as well since they could use the empirical findings of our research as a blueprint

for additional training in specific skills they deemed lacking in their profile to become more marketable to future employers (Jakobsen *et al*., 2019). Finally, this study is relevant for higher education institutions and, more broadly, for accounting educational programs, as it unveils the multifaceted nature of modern-day management accounting jobs and the consequent need for a more varied conceptual background featuring not only pure accounting skills but also IT knowledge and interpersonal communication skills.

As with all LDA-based studies, the results should be interpreted with certain limitations (Culasso *et al*., 2023; Nielsen, 2022). First, topic modeling allows for a "snapshot" of the current job marketplace, thus limiting the perspective. Future studies could employ a longitudinal approach to unveil how management accountants have evolved by comparing data from multiple periods. Second, we purposefully attempted to include as many job postings as possible by extracting data from different countries. While we took all the precautions necessary to work with text originally elaborated in different languages, a certain degree of "human error" remains in the translation process. Additionally, while LDA allows for the comparative study of management accounting job postings, it cannot decipher the context in which words are used. The above introduces some errors in the measurement, as the algorithm could mistakenly group words referring to different topics due to their textual proximity. A further set of limitations comes with the LDA algorithm itself. One of its primary disadvantages is the assumption that topics and documents are independent with one another, which is not always the case, thus resulting in possible inaccuracies when it comes to comprehensively capture the topic structure of a corpus. To expand upon the limitations of LDA topic modeling, we suggest future research to combine textual analysis with the experience of accounting professionals, possibly through a mixed, qualitative and quantitative approach. Alternatively, scholars could replicate the study with different topic models, such as the structural topic model (Roberts *et al*., 2019) and the embedded topic model (Dieng *et al*., 2020).

A further limitation of the study comes with the perspective we employed for the analysis. More specifically, since job descriptions are generally formulated by the employer, our study is not able to rule out selection bias, as the competencies and tasks explored in the study are dictated by the job postings. Additionally, our research draws from the current job marketplace, thus leaving out the point of view of already employed professionals, and features postings biased by the current needs of companies, which may vary depending on their sector or their life cycle stage. Future research could expand upon said limitations by exploring the perspective of management accountants themselves, possibly through qualitative research, in order to gather further

insights on the matter. In conclusion, our study features a few pathways for future research. First, we presented a descriptive overview of how the distribution of topics differs across countries. However, at this specific time, we have minimal knowledge of the motives behind the emerging differences. Future research could employ a cross-cultural approach to compare management accountants' profiles in multiple countries, including non-European nations. Additionally, future studies could further explore the topic of sustainability reporting and management accounting from a competency perspective to better understand the skills companies look for in newly appointed management accountants or whether they prioritize sustainability "experts" with a different background.

References

Anthony R.N. (1965), *Planning and Control Systems: A Framework for Analysis*, Harvard Business School Press.

Ascani I., Ciccola R., Chiucchi M.S. (2021), A structured literature review about the role of management accountants in sustainability accounting and reporting. *Sustainability*, 13(4), 2357. Doi: 10.3390/su13042357.

Asmussen C.B., Møller C. (2019), Smart literature review: a practical topic modelling approach to exploratory literature review, *Journal of Big Data*, 6(1). Doi: 10.1186/s40537-019-0255-7.

Beaman I., Richardson B. (2007), Information technology, decision support and management accounting roles, *Journal of Applied Management Accounting Research*, 5, pp. 59-68.

Bhimani A. (2020), Digital data and management accounting: why we need to rethink research methods. *Journal of Management Control*, 31(1-2), pp. 9-23. Doi: 10.1007/s00187-020-00295-z.

Bhimani A., Willcocks L. (2014), Digitisation, 'Big Data' and the transformation of accounting information, *Accounting and Business Research*, 44(4), pp. 469-490. Doi: 10.1080/00014788.2014.910051.

Bradbard D.A., Alvis C., Morris R. (2014), Spreadsheet usage by management accountants: An exploratory study, *Journal of Accounting Education*, 32(4), pp. 24-30. Doi: 10.1016/j.jaccedu.2014.09.001.

Brown D., Cooper D. (2019), Skills for the future? The changing role of the management accountant. *Accounting, Auditing & Accountability Journal*, 32(1), pp. 64-83.

Budding T., de Jong G., Smit M. (2022), New development: Bridging the gap-analysis of required competencies for management accountants in the public sector, *Public Money & Management*, pp. 1-4. Doi: 10.1080/09540962.2022.2068862.

Bui B., Porter B. (2010), The expectation-performance gap in accounting education: an exploratory study, *Accounting Education*, 19(2), pp. 23-50.

Byrne S., Pierce B. (2007), Towards a more comprehensive understanding of the roles of management accountants. *The European Accounting Review*, 16(3), pp. 469-498. Doi: 10.1080/09638180701507114.

Carlsson-Wall M., Goretzki L., Hofstedt J., Kraus K., & Nilsson C.-J. (2022), Exploring the implications of cloud-based enterprise resource planning systems for public sector management accountants, *Financial Accountability and Management*, 38(2), pp. 177-201. Doi: 10.1111/faam.12300.

Cavélius F., Endenich C., Zicari A. (2020), Back to basics or ready for take-off? The tensions on the role of management controllers in the digital age, *Comptabilité - Contrôle - Audit*, Tome 26(2), pp. 89-123. Doi: 10.3917/cca.262.0089.

Chartered Institute of Management Accountants (CIMA) (2018), *Global management accounting principles: Driving better business through improved performance*, London, CIMA.

Cheffi W., Abdel-Maksoud A., Farooq M. O. (2021), CSR initiatives, organizational performance and the mediating role of integrating CSR into management control systems: Testing an inclusive model within SMEs in an emerging economy, *Journal of Management Control*, 32(3), pp. 333-367. Doi: 10.1007/s00187-021-00323-6.

Chiucchi M.S., Gatti M. (2015), Editoriale. L'evoluzione degli studi di management control: un percorso nel segno della varietà, *Management Control*, 1, pp. 5-8, Milano, FrancoAngeli. Doi: 10.3280/maco2015-001001.

Culasso F., Gavurova B., Crocco E., Giacosa E. (2023), Empirical identification of the chief digital officer role: A latent Dirichlet allocation approach, *Journal of Business Research* (Vol. 154, 113301). Elsevier BV. Doi: 10.1016/j.jbusres.2022.113301.

Dieng A.B., Ruiz F.J.R., Blei D.M. (2020), Topic Modeling in Embedding Spaces, *Transactions of the Association for Computational Linguistics* (Vol. 8, pp. 439-453), MIT Press - Journals. Doi: 10.1162/tacl_a_00325.

Ge C., Shi H., Jiang J., Xu X. (2022), Investigating the demand for blockchain talents in the recruitment market: Evidence from topic modeling analysis on job postings, *Information & Management*, 59(7), 103513. Doi: 10.1016/j.im.2021.103513.

Goretzki L., Strauss E. (2017), Introduction, *The Role of the Management Accountant* (pp. 1-6), Routledge.

Heinzelmann R. (2019), Digitalizing Management Accounting, *Controlling – Aktuelle Entwicklungen und Herausforderungen* (pp. 207-226). Springer Fachmedien Wiesbaden.

Hoozée S., Mitchell F. (2017), Who Influences the Design of Management Accounting Systems? An Exploratory Study, *Australian Accounting Review* (28(3), pp. 374-390). Wiley. Doi: 10.1111/auar.12193.

Hung S.K., Ching P.S., Fen L.A. (2019), Accounting students' perception on skills and attributes required becoming management accountant. Proceedings of the 2019 2nd International Conference on E-Business, Information Management and Computer Science.

Jackling B., De Lange P. (2009), Do accounting graduates' skills meet the expectations of employers? A matter of convergence or divergence, *Accounting Education*, 18(5), pp. 369-385.

Jakobsen M., Mitchell F., Nørreklit H., Trenca M. (2019), Educating management accountants as business partners: Pragmatic constructivism as an alternative pedagogical paradigm for teaching management accounting at master's level, *Qualitative Research in Accounting & Management*, 16(4), pp. 517-541. Doi: 10.1108/qram-10-2017-0099.

Jusoh R., Yahya Y., Zainuddin S., Asiaei K. (2021), Translating sustainability strategies into performance: does sustainability performance management matter?, *Meditari Accountancy Research*, ahead-of-print(ahead-of-print). Doi: 10.1108/medar-02-2021-1203.

Kavanagh M. H., Drennan L. (2008), What skills and attributes does an accounting graduate need? Evidence from student perceptions and employer expectations, *Accounting & Finance*, 48(2), pp. 279-300.

Král B., Mikołajewicz G., Nowicki J., Šoljaková L. (2021), Management accountants' professional competences: Requirements in the Czech Republic and Poland, *The normative approach and business practice. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 69(3), pp. 379-393. Doi: 10.11118/actaun.2021.035.

Lawson R.A., Blocher E.J., Brewer P.C., Cokins G., Sorensen J. E., Stout D.E., Sundem G.L., Wolcott S.K., & Wouters M.J.F. (2014), Focusing accounting curricula on students' Long-Run careers: Recommendations for an integrated competency-based framework for accounting education, *Issues in Accounting Education*, 29(2), pp. 295-317. Doi: 10.2308/iace-50673.

Littleton A.C. (1928), Reviews and notices. *The Bulletin of the National Tax Association*, 14(1), pp. 30-32. Doi: 10.1086/bullnattax41786071.

Lombardi R. (2021). Le dimensioni della conoscenza aziendale. Profili di investigazione tra crisi pandemica ed economia digitale, *Management Control*, 3, pp. 5-14, Doi: 10.3280/maco2021-003001.

Macintosh N.B. (1985), *The Social Software of Accounting and Information Systems*. Wiley.

Magnacca F., Giannetti R. (2023), Management accounting and new product development: a systematic literature review and future research directions, *Journal of Management and Governance*, Doi: 10.1007/s10997-022-09650-9.

Mikalef P., Boura M., Lekakos G., Krogstie J. (2019), Big data analytics and firm performance: Findings from a mixed-method approach, *Journal of Business Research*, 98, pp. 261-276. Doi: 10.1016/j.jbusres.2019.01.044.

Munir S., Abdul Rasid S. Z., Aamir M., Jamil F., Ahmed I. (2022), *Big data analytics capabilities and innovation effect of dynamic capabilities, organizational culture and role of management accountants*. Doi: 10.1108/fs-08-2021-0161.

Nielsen S. (2022), Management accounting and the concepts of exploratory data analysis and unsupervised machine learning: a literature study and future directions, *Journal of Accounting & Organizational Change*, ahead-of-print(ahead-of-print). Doi: 10.1108/jaoc-08-2020-0107.

Nita B. (2016), The State and Development Trends of Management Accounting in the Global Environment, *Wsb Univ. Pozn. Res. J*, 66, pp. 107-117.

Oppi C., Vagnoni E. (2020), Management accountants' role and coercive regulations: evidence from the Italian health-care sector, *Qualitative Research in Accounting & Management*, 17(3), 405-433. Doi: 10.1108/qram-02-2019-0040.

Ott C. (2022), The professional identity of accountants – an empirical analysis of job advertisements. In *Accounting, Auditing &amp, Accountability Journal* (36(3), pp. 965-1001). Doi: 10.1108/aaaj-08-2021-5389.

Papoutsoglou M., Rigas E. S., Kapitsaki G. M., Angelis L., Wachs J. (2022). Online labour market analytics for the green economy: The case of electric vehicles, *Technological Forecasting and Social Change* (Vol. 177, p. 121517), Elsevier BV. Doi: 10.1016/j.techfore.2022.121517.

Paulsson G. (2012), The role of management accountants in new public management: The role of management accountants, *Financial Accountability and Management*, 28(4), pp. 378-394. Doi: 10.1111/j.1468-0408.2012.00552.x.

Rai P., Vatanasakdakul S., Aoun C. (2010). Exploring perception of IT skills among Australian accountants: An alignment between importance and knowledge. -- http://aisel.aisnet.org/amcis2010/153.

Richardson P., Dellaportas S., Perera L., Richardson B. (2015). Towards a conceptual framework on the categorization of stereotypical perceptions in accounting. *Journal of Accounting Literature*, 35, pp. 28-46.

Roberts M.E., Stewart B.M., Tingley D. (2019), STM: An R Package for Structural Topic Models, *Journal of Statistical Software*, 91(2). Doi: 10.18637/jss.v091.i02.

Schaltegger S., Etxeberria I.A., Ortas E. (2017), Innovating Corporate Accounting and Reporting for Sustainability-Attributes and Challenges. *Sustain. Dev*, 25, pp. 113-122.

Schouten K., Frasincar F. (2016), Survey on aspect-level sentiment analysis, *IEEE Transactions on Knowledge and Data Engineering*, 28(3), pp. 813-830. Doi: 10.1109/tkde.2015.2485209.

Simons R. (1995), *Levers of control: how managers use innovative control systems to drive strategic renewal*, Harvard Business School.

Siriwardane H.P., Low K.-Y., Blietz D. (2015), Making entry-level accountants better communicators: A Singapore-based study of communication tasks, skills, and attributes, *Journal of Accounting Education*, 33(4), pp. 332-347. Doi: 10.1016/j.jaccedu.2015.08.001.

Sorensen J.E. (2009), Management accountants in the United States: Practitioner and academic views of recent developments, *Handbook of Management Accounting Research* (pp. 1271-1296), Elsevier.

Spraakman G., O'Grady W., Askarany D., Akroyd C. (2015), Employers' perceptions of information technology competency requirements for management accounting graduates, *Accounting Education*, 24(5), pp. 403-422. Doi: 10.1080/09639284.2015.1089177.

ten Rouwelaar H., Schaepkens F., Widener S.K. (2021), Skills, influence, and effectiveness of management accountants, *Journal of Management Accounting Research*, 33(2), 211-235. Doi: 10.2308/jmar-18-048.

Thaller J., Duller C., Feldbauer-Durstmüller B., Gärtner B. (2023), Career development in management accounting: empirical evidence, *Journal of Applied Accounting Research*, Doi: 10.1108/jaar-03-2022-0062.

Tillema S., Trapp R., van Veen-Dirks P. (2022), Business Partnering in Risk Management: A Resilience Perspective on Management Accountants' Responses to a Role Change*, *Contemporary Accounting Research*, 39(3), pp. 2058-2089), Doi: 10.1111/1911-3846.12774.

van der Steen M. P. (2022), Identity work of management accountants in a merger: The construction of identity in liminal space, *Management Accounting Research*, 56, 100792, Doi: 10.1016/j.mar.2022.100792.

Wadan R., Teuteberg F., Bensberg F., Buscher G. (2019), Understanding the changing role of the management accountant in the age of industry 4.0 in Germany, *Proceedings of the 52nd Hawaii International Conference on System Sciences*.

Webb J., Chaffer C. (2016), The expectation performance gap in accounting education: a review of generic skills development in UK accounting degrees, *Accounting Education*, 25(4), pp. 349-367. Doi: 10.1080/09639284.2016.1191274.

Wolf T., Kuttner M., Feldbauer-Durstmüller B., Mitter C. (2020), What we know about management accountants' changing identities and roles – a systematic literature review, *Journal of Accounting & Organizational Change*, ahead-of-print(ahead-of-print). Doi: 10.1108/jaoc-02-2019-0025.