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Digital Skills of Management Accountants:

A Comparative Analysis across EU Countries

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Abstract

The Fourth Industrial Revolution is bringing significant changes to the digital skill set required of management accountants. Thus, to continue ensuring the profession's relevance, academia and professional bodies constantly seek to update their curricula to meet the business environment's necessities. Thus, the present research aims to identify the digital skills management accounting practitioners need by examining the companies' requirements and determining whether there are significant differences between European Union (EU) member states regarding the countries' digital performance. This study adopts a mixed-methods approach by combining qualitative and quantitative research methods to achieve this objective. The results obtained from the undertaken analyses reveal that most companies consider necessary basic digital skills, such as the effective use of spreadsheet software and competencies related to integrated systems, Business Intelligence, database management systems, and data warehouse management systems. In addition, the comparative review reveals that in countries with a high level of digital performance there is a significant impact on the professional requirements, with no differences being identified between countries with a medium and low level of digital performance, emphasising the changing role of practitioners as a result of the extensive management accounting processes' digitalisation. The research findings consequently have a series of implications for academia, professional bodies, and companies.

***Key words**: digital skills; management accounting; accounting profession; job advertisements;*

***JEL Classification**: J24, M41, O33*

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Introduction

The management accountants' role underwent considerable transformations in the last decades due to technological developments and business environment changes, which became more complex and dynamic. The advancement in artificial intelligence (AI), process automation, and data analytics are driving changes in the management accountants' role and the required skill set. Within the context of the Fourth Industrial Revolution, also referred to in the literature as Industry 4.0, management accountants are presented with the opportunity to benefit from a range of new equipment and infrastructure that enables complex analytical methods to effectively pursue (1) the development of the optimal decision-making context, (2) budgetary control, (3) forecasting, and (4) the management of key financial and operational factors, contributing to this new paradigm through their skill set and professional judgement (Dai & Vasarhelyi, 2023).

In response to the business environment's dynamics and developments in the Information Technology (IT) field, professional bodies, whose role over time has been to maintain the relevance of the profession (King & Davidson, 2009; Tsiligiris & Bowyer, 2021), frequently update their curricula for future certified practitioners (Rîndaşu et al., 2023). Hence, the newest skills required by the professional bodies of management accountants relate to the effective use of AI, Blockchain solutions, Business Intelligence (BI), Internet of Things (IoT), process automation (RPA), mobile technologies, and data analytics solutions.

Even though international professional bodies continually engage with the business environment, Howcroft (2017) outlines that employers believe entry-level certified practitioners do not have all the necessary skills. Conversely, professional bodies consider that entry-level professionals are overqualified for the positions offered by the labour market as they need more opportunities to practise the skills developed during the university studies and certification process.

The skills gap between management accountants and the companies' demands continues to be an ongoing concern (Edeigba, 2022; Elo et al., 2023; Oesterreich & Teuteberg, 2019; Rajeevan, 2019), especially in a context where the practitioners' role and their career development are affected by the extensive digitalisation of processes (Wolf et al., 2020). Although previous studies have provided important insights into the digital skills gap between the companies' expectations and the management accountants' profile (Oesterreich & Teuteberg, 2019; Wadan & Teuteberg, 2019) these findings are limited to one country, consisting of a limited set of digital skills and did not provide a comparative analysis between different states. Therefore, this research aims to identify the digital skills set required by companies and conduct a comparative analysis between European Union (EU) countries according to the digital performance of each nation. The authors firstly conduct a content analysis of 570 jobs to achieve this objective, examining the digital skills set and then wielding a comparative quantitative research method. Therefore, the current study provides an important contribution by deepening the understanding of the business environment dynamics that contribute to management accountants' transforming roles.

This paper is structured in four sections. The first section reviews the relevant literature on the profession's transformation, the evolution of the management accountants' career paths and the digital skill set, followed in section two by an overview of the methodological research framework. The third section outlines the findings and discusses the results. Lastly, the conclusions, limitations, and future research directions are presented in the final section.

Literature review

Digitalisation, as defined by Brennen & Kreis (2016) as "the way in which many areas of social life are being restructured around digital communication and media infrastructures", is one of the main drivers that is transforming the accountancy profession, leading to the generation of new roles and changes in the management accountants' career paths. Although the literature recognises digitalisation's impact on the profession, there are two perspectives through which researchers approach this transformation. The first view considers the development of the practitioner's role and the creation of new opportunities by shifting from the "bean counter" stereotype towards a business partner role (Andreassen, 2020; Tiron-Tudor & Deliu, 2021; Leitner-Hanetseder et al., 2021) focusing on new opportunities that accountants can leverage. In this context, Leitner-Hanetseder et al. (2021) argue that future practitioners must develop their skill sets to successfully engage in new jobs driven by advances in AI. The second perspective is contrary and assumes that a high degree of digitalisation will gradually lead to the processes de-professionalisation, which will no longer be associated with management accounting to the detriment of IT departments (Heinzelmann, 2018; Zhang et al., 2023).

By examining the new IT solutions' impact on the required skill set of entry-level accounting practitioners from both the executives' and junior professionals' perspectives, Jackson et al. (2022) discover that both groups comprehend the need for a well-defined set of digital skills for future career sustainability, emphasising the idea that in a context characterised by AI and RPA, entry-level accountants are more impacted by the transforming roles. Similarly, Schäffer & Weber (2017) suggest that digitalisation, standardisation, and process outsourcing determines companies to no longer nurture the traditional career development of management accountants by supporting their skills development.

In an attempt to provide a glimpse into the future of the accounting profession, Leitner-Hanetseder et al. (2021) consider that although the impact of digitalisation's evolution on the profession is difficult to quantify, an extensive collaboration between the human factor and IT solutions is emerging in the near future, with accounting teams being characterised by a collaborative ability, an increased level of openness, flexibility, and interdisciplinarity. In this context, digitalisation will empower management accountants to become effective business partners and contribute to sustainable performance, the skill set being focused on data analytics, AI, and data forecasting and visualisation techniques. Nevertheless, further analysis is needed as the role's transformation appears to be more complex than the scenarios presented in the digitalisation discourses, with the organisations' type as one of the main antecedents of the evolution of the management accountants' role (Carlsson-Wall et al., 2022)

Currently, shifts can be observed in how management accountants develop their career paths, with an increasing inclination towards short-term lateral career moves due to decreased employer loyalty (Thaller et al., 2023). Digitalisation is one of the main drivers of this change in career paths and organisations must provide opportunities for practitioners to employ their skills. Thus, the role's transformation leads to changes in the necessary set of skills, with practitioners having to develop new competencies in addition to their core aptitudes to meet the new role challenges (Wolf et al., 2020).

The management accountants' skill set can be examined through three perspectives, considering the triad of universities, professional bodies, and the business environment. Although higher education institutions and professional bodies have been and continue to be separate pillars of the accounting education, most university programs are accredited by or part of agreements with national and/or international professional bodies and associations, resulting in frequent changes in the curricula (Sarkar et al., 2021). This is because professional bodies and associations have a better collaboration with the business environment (Tsiligiris & Bowyer, 2021); thus, it is considered that they have more detailed insights into the companies' needs and challenges. Therefore, in response to the exerted pressure from companies, society, and competitors, higher education institutions are attempting to remain competitive to prepare professionals to meet the evolving IT challenges.

While academia consistently strives to provide relevant curricula that contribute to the future practitioners' sustainable career development, the literature indicates a gap between the accountants' skills and the business environment's requirements. By analysing the consistency between the competencies of more than 2300 management accountants, Oesterreich & Teuteberg (2019) discovered that the current practitioner's profile is inconsistent with the future role highlighted by the literature and professional bodies. Several factors may cause the existence of this gap. For instance, in the context of introducing a new IT discipline into an undergraduate accounting program, Sakar et al. (2021) identify the following challenges: lack of educators with the necessary skills, limited training activities, the difficulties and complexities associated with learning new IT solutions, and a lack of incentives for professional development. Conversely, Cheng et al. (2022) argue that this gap should not be attributed solely to academia, as there is a need for continuous collaboration between businesses, higher education institutions, and government representatives.

Lately, many researchers have been focused on examining the set of digital skills needed by accounting practitioners in the context of Industry 4.0 (Andreassen, 2020; Carlsson-Wall et al., 2022; Liu et al., 2021; Oesterreich & Teuteberg, 2019; Roozen et al., 2019; Spraakman et al., 2021). The most commonly reported competencies relate to effectively working with: solutions for data analytics and BI, data visualisation techniques, cloud computing platforms, Enterprise Resource Planning (ERP) systems, AI, RPA, and Blockchain solutions. Reviewing the evolution of the digital skills set in the syllabi of two major management accounting professional

bodies, Rîndaşu et al. (2023) uncover a similar set of competencies, outlining that the profile of management accountants in the context of process digitalisation focuses on six pillars: (1) supporting the organisation in the digital transformation processes, (2) understanding the key technologies that have significant potential for companies, (3) continuously developing the skill set, (4) leveraging digitalisation as a foundation for the decision-making process, (5) proposing strategies to address the disruptions caused by technological progress, and (6) protecting data and being digitally responsible.

Building on this literature review, this research aims to identify the skill set required by the business environment, examining the practitioners' digital profile comparatively across EU countries.

Research Methodology

Based on the research objective of examining the management accountants' profile in terms of digital skills in the context of EU countries, we sought answers to the following research questions:

RQ1. What are the digital skills required of management accountants in EU countries?

RQ2. Are there differences in the digital skills required of management accountants across EU countries?

In order to answer the first research question, we wielded an inductive approach using a cross-sectional qualitative method by analysing job advertisements targeting management accountants. To answer the second question, a quantitative research method was used to explore the differences in the digital skills set, employing nonparametric tests to determine whether there are significant gaps between countries according to their level of digitalisation.

Data collection

Job advertisements are an important source of data as they exhibit clear information about the tasks and responsibilities of available positions, reflecting companies' expectations of future employees (Kim & Angnakoon, 2016; Walińska & Dobroszek, 2021), thus allowing the examination of the accounting practitioners' required skill set.

Using international recruitment platforms such as LinkedIn and Glassdoor, as well as national platforms, 570 job advertisements were collected. Thirty ads were selected for each EU member country with a population of more than 5 million, thus excluding eight countries (Cyprus, Croatia, Estonia, Latvia, Lithuania, Luxembourg, Malta, and Slovenia) from the analysis, as per the demographic data provided by Eurostat (2022).

Based on the quantitative paradigm and the concept of data saturation (Corbin & Strauss, 2015), the sample size for each country is appropriate given that no additional digital skills were identified after analysing a certain number of items set initially. In this study, given the principles proposed by Francis et al. (2010), an initial sample of 20 advertisements was set and ten more advertisements were examined for the stopping criterion.

The ads selection was random and manual, considering several conditions to ensure methodological relevance. Considering the hybridisation of accounting jobs determined by the management accountants' skills overlapping with competencies from the financial accounting field (Albu et al., 2011) and the blurred boundaries caused by the practitioners' role in transversal activities (Samanthi & Gooneratne, 2023), the jobs selection was not solely based on job title. Thus, we considered the existence of specific management accounting responsibilities such as budgeting, forecasting, costing, data analysis, and performance measurement (Albu et al., 2011; CIMA, 2023). Advertisements that did not target practitioners with accounting experience or education were excluded from the analysed sample. At the same time, to avoid bias in the dataset, a maximum of two different jobs from the same company at the country level and a maximum of four advertisements from the same employer at the EU level were selected.

Taking into account the considerations outlined above, no automatic data retrieval methods have been used. Such a result based on the analysis of the position title alone could have contained erroneous data, with advertisements referring to positions in the financial field, such as accountant or cost manager, but requiring future employees to hold a degree in the construction field. While the job responsibilities referred to estimating production costs, preparing and monitoring budgets, and implementing new methods for building budgets, these positions did not refer to accounting professionals.

Data analysis

The selected job advertisements were examined by using content analysis, which is an extensively employed method for collecting data through the classification of text items (Ott, 2023).

Most of the ads were collected from LinkedIn, where the ads are often structured in four sections. The first section includes the job title, company name and company details (industry and number of employees), as well as the level of experience required of the candidates. The second section contains a description of the activities related to the position, with most companies including here the main responsibilities and less frequently mentioning the IT solutions to be used by future employees. The third section contains details of the competencies required of the practitioners, including all the aspects employers consider crucial for accomplishing the job responsibilities. The last section, typical for most workplaces, describes the companies and their missions. For this study, mainly the first three sections were analysed.

As identifying the digital skill set implies examining the requirements in the context of the position and terms used in practice, manual analysis and coding are considered more appropriate assessment methods (Ott, 2023). As digital competencies and IT solutions have been identified, they have been included in the digital skills set required. In cases where the advert included IT solutions covering more than one skill, all of the specific competencies were considered. The coding was performed as follows: if any requirements for the skill were identified in the advertisement, it was assigned a value of 1; otherwise, it was assigned a value of 0.

The companies have been divided into two categories (services and manufacturing) according to the sector in which they operate, with organisations from more than 200 fields being analysed; in terms of the number of employees, the majority of jobs examined (67.02%) is offered by companies with more than 1000 employees (**Table no. 1**). Concerning the level of experience, most of the advertisements targeted practitioners with at least three years of experience (associate level – 34.21%) and between five and seven years (senior level – 32.11%); 102 advertisements referred to practitioners at the beginning of their careers, with no more than two years of experience in the field, and 84 of the jobs targeted executive positions. For six jobs we could not identify the level of experience sought by the employers.

Table no. 1. Details of the jobs sample analysed

Number of employees / Industry	Manufacturing (M)	Services (S)	Total
1-10	0	2	2
11-50	6	21	27
51-200	18	40	58
201-500	14	38	52
501-1000	14	35	49
1001-5000	51	86	137
5001-10000	23	25	48
Above 10000	110	87	197
Total	236	334	**570**

Source: Own processing based on the data collected

Results and discussions

The study's objective is to examine the business requirements that shape the digital skills set needed by management accounting practitioners. After reviewing 570 job advertisements from 19 EU member countries, we identified 54 ads (9.47%) for which no digital skills could be identified due to the requirements' ambiguity or the absence of any mention within the advertisements. A few examples which reflect the lack of clarity are the following: "IT skills and responsiveness to evolving IT systems", "[...] strong interest and experience in using IT tools", and "relevant IT skills".

An overview of the main identified competencies is presented in **Table no. 2**. The most frequent of these is represented by basic digital skills, such as proficiency with spreadsheet software and other MS Office Suite (MSO) applications, encountered in 431 ads (75.61%). As can be noticed, these basic digital skills are found across all types of industries, regardless of the company size. Although some businesses with a certain level of digital maturity are moving away from using spreadsheet software and opting

to use integrated systems, these basic IT solutions remain relatively popular. This result is consistent with previous studies (Rîndaşu, 2021; Schmidt et al., 2020), observing further resistance to adopt new, more appropriate data analysis and visualisation solutions.

As can be noticed, the competencies with integrated systems such as Enterprise Resource Planning (ERP) are the second most requested skill (51.58%), the prevalent requested solution being the one offered by SAP SE. Some of the advertisements examined mentioned the modules that future employees are expected to know, the most common being SAP FI and SAP CO, although the majority of companies omitted to specify this. In cases where modules such as SAP BW or SAP BPC were specified, these skills were considered part of the Business Intelligence (BI) category and the Accounting and Performance Management Information Systems (AIS/BPC) category. In the case of 12 advertisements, it was observed that companies prefer professionals with experience in implementing ERP systems, which is a critical success factor when adopting new solutions (Alsharari et al., 2020). Thus, companies that prefer candidates previously involved in such activities might easily overcome the specific associated challenges.

Although AIS/BPC have a similar utility to some of the modules available in the ERP systems, they have been presented separately because the advertisements did not always specify an integrated solution and, in the analysed cases, skills related to such specific software were required.

The following most frequently identified competencies referred to working with BI solutions (24.91%) and database and data warehouse management systems (DBMS&DW – 12.80%). In comparison with the previous study conducted by Rîndaşu (2021), it can be seen that the prevalence of these types of skills is significantly higher than in the previous periods. This result may be explained by the fact that management accounting practitioners, as opposed to financial accountants, have to demonstrate a higher level of data analysis and interpretation skills.

The following three types of competencies identified relate to the use of data analysis (DA), process automation (RPA), and data visualisation (DV) techniques. Although these are relatively less common than the skills presented above, it can be seen that the set of digital competencies required of management accountants is expanding to enable practitioners to successfully fulfil their role as business partners (Andreassen, 2020; Tiron-Tudor & Deliu, 2021; Leitner-Hanetseder et al., 2021).

Table no. 2. Identified digital skills

Number of employees (Industry)/ Skills	MSO	ERP	BI	AIS/BPC	DBMS&DW	DA	RPA	DV
1-10 (S)	1	1	0	0	0	0	0	0
11-50 (M)	5	4	2	2	1	0	0	0
11-50 (S)	12	4	3	6	1	1	2	0
51-200 (M)	12	10	7	1	3	1	1	0
51-200 (S)	33	14	10	2	4	1	0	0
201-500 (M)	12	11	5	2	3	1	1	0
201-500 (S)	27	15	7	9	6	5	1	0
501-1000 (M)	6	10	5	2	2	2	0	0
501-1000 (S)	26	14	7	4	6	2	0	4
1001-5000 (M)	38	37	12	5	5	3	2	1
1001-5000 (S)	70	35	23	9	12	10	2	3
5001-1000 (M)	18	14	6	2	0	4	1	0
5001-1000 (S)	15	11	3	4	2	3	2	1
Above 10000 (M)	87	77	33	8	15	6	4	3
Above 10000 (S)	69	37	19	8	13	8	3	4
Total	431	294	142	64	73	47	19	16

Source: Own processing based on the data collected

Besides these eight types of skills, sporadically, we encountered competencies related to programming languages (LP – 9 ads) and project management IT solutions (PM – 9 ads). Two of the advertisements reviewed referenced decentralised registries (DR) – Blockchain, with one advertisement requiring practitioners to have in-depth knowledge of operating systems (OS) and one item mentioning competencies related to cloud computing platforms (CC).

To determine whether there are significant differences between EU countries according to the level of digitalisation in each country, as assessed by the European Commission's Digital Economy and Society Index (DESI) (Eurostat, 2022), all countries were classified into three categories based on their level of digitalisation. The first category includes states with higher digital performance, the second category refers to countries with an average performance, and the last category refers to countries with a low level of digitalisation. K-Mean Cluster statistical analysis was used to perform the classification, for which an initial number of three clusters and a maximum of ten iterations were set (F=84.942, p<0.01). A score based on the number of skills was calculated for each of the ads in the sample. For jobs where no digital skills were mentioned the score was 0 and for the other jobs, depending on the number of skills, the score ranged from 1 (one skill identified) to 5 (five skills identified). The nonparametric Kruskal-Wallis H test was employed to determine whether there were differences between the means of these groups, with the results presented in **Tables 3** and **4**. The Levene test was used to assess whether the dataset meets the assumption of homogeneity of variance (p=0.166>0.05), thus rejecting the null hypothesis.

Table no. 3. Ranking of advertisements according to the country's level of digitalisation

	Digitalisation_level	N	Mean Rank
Digital_score	High	180	259.41
	Medium	210	299.34
	Low	180	295.45
	Total	570	

Source: Own processing using SPSS V.18

Table no. 4. Test Statisticsa,b

	Digital_score
Chi-square	7.200
df	2
Asymp. Sig.	.027
a. Kruskal Wallis Test b. Grouping Variable: Digitalisation_level	

Source: Own processing using SPSS V.18

As can be observed, there are statistically significant differences (p=0.027<0.05) between the three categories of countries examined, but with a low effect size (η^2= 0.013). In order to determine which of the categories has conclusive differences, we used the Mann-Whitney U nonparametric test to compare the groups two by two (**Table no. 5**).

Table no. 5. Test Statisticsa

	Digital_score (High vs. Medium)	Digital_score (Medium vs. Low)	Digital_score (High vs. Low)
Mann-Whitney U	16213.50	18681.00	14189.50
Wilcoxon W	32503.50	34971.00	30479.50
Z	-2.527	-.205	-2.111
Asymp. Sig. (2-tailed)	.012	.837	.035
a. Grouping Variable: Digitalisation_level			

Source: Own processing using SPSS V.18

Based on the comparison between groups, it can be noted that there are statistically significant differences between countries with a high and medium level of digitalisation ($p=0.012<0.05$) and a low level of digitalisation ($p=0.035<0.05$), with no significant gap between the last groups. This result highlights that in countries with a higher level of digitalisation, there is a significant impact on the professional requirements, most likely due to the increased level of competition and the organisations' needs to use more IT solutions to increase the performance measurement's quality. At the same time, considering that most of the jobs examined were offered by multinational companies, an impact of globalisation can be expected, leading to an increase in skills. The lack of a statistically significant difference between countries with a medium and low level of digitalisation can be explained by the fact that organisations from countries with a lower digital performance try to close this gap by digitally transforming their businesses.

Conclusions

This research aimed to examine the digital skill set required of management accountants by employers and to examine comparatively whether there are significant differences between EU countries. To achieve the research objective, an inductive approach was initially employed, applying a qualitative research method to identify the digital skills required of the management accountants, while quantitative methods were applied to examine whether there are significant differences in the skill set depending on the countries' level of digitalisation.

The initial assessment revealed 13 types of skills, the most common referring to basic digital skills, ERP systems, and business intelligence solutions, as well as skills for working with databases and data warehouses, data analysis, and visualisation techniques. Comparing the results obtained with the set of digital skills defined by the relevant international professional bodies (Rîndaşu et al., 2023), it can be noticed that there are no relevant differences. The comparative analysis conducted revealed that although the countries' level of digitalisation contributes to the increasing need of organisations to hire higher level digital skills practitioners, even in countries with lower digital performance companies emphasise the need for an adequate skill set, a fact that may be caused by the goal of fostering competitive advantages in an economic environment characterised by globalisation and standardisation. Thus, these results point to the changing profile of management accountants in the context of Industry 4.0, where practitioners need to demonstrate an optimal level of digital skills to meet the demands of their role as business partners. While skills related to emerging technologies such as cloud computing platforms, decentralised ledgers and process automation solutions are less common, the expectation is that this outcome will change in the near future.

The study's findings could be used to draw several implications for academia, professional bodies, and companies. The profession's relevance can be further ensured through an up-to-date accountancy education that manages to prepare practitioners with an appropriate set of skills. Therefore, higher education institutions and professional bodies need to continuously dialogue with the business environment as the increasing degree of digitalisation may lead to a de-professionalisation of the specific management accounting processes. At the same time, companies must formulate precise requirements so as to avoid the emergence of a gap between the skills required in accounting education and those needed in the professional context.

The main limitation of the current research is related to the companies' level of transparency regarding the requirements set out in the job advertisements. Rieg et al. (2023) consider that the job description and competencies called for in recruitment advertisements may be intentionally limited, as companies aim to attract as many candidates as possible, followed by more thorough filtering in the later stages of selection. Therefore, we do not exclude the possibility that jobs may involve additional digital skills that were not included in the advertisements, either as these skills are to be learned on the job or because those were not considered highly relevant. Therefore, future research could target why employers prefer to limit the digital skills required of management accounting practitioners.

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