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A hierarchical clustering analysis of the management accounting practices perceptions in Romania

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Abstract

This study examines the issue of understanding management accounting practices in Romanian financial and accounting service firms, a subject of significant relevance due to the influence of accounting on organizational decision-making and strategic planning. The research examines 21 distinct management accounting practices, utilizing hierarchical clustering analysis refined by the Bayesian Information Criterion (BIC) to discern patterns and classifications within these practices. The findings indicate eight unique clusters, distinguished by differences in cluster size, within-cluster heterogeneity, total within-cluster sum of squares, and Silhouette scores, which explain the diversity of practices and their organizational implications. The research enhances the literature by delineating the present state of management accounting practices in Romania and providing a more refined comprehension of the interrelationships among these practices, as guided by institutional theory. This method surpasses other attempts by emphasizing the diversity within clusters, uncovering distinct traits and strategic consequences. The findings indicate that various groupings of practices demonstrate particular patterns of adoption and utilization, which might affect firms' strategic decision-making processes. These insights facilitate future research focused on examining the drivers and effects of accounting methods across various institutional contexts.

Keywords: managerial accounting, hierarchical clustering, accounting practices, cluster analysis, institutional theory, perceptions analysis, Romanian firms.

1 Introduction

Strategic decision-making processes inside organizations are greatly impacted by management accounting procedures, particularly in the dynamic world of accounting and finance.

In order to contextualize this study within the wider debate around management accounting methods and their effects on strategic decision-making within the Romanian setting, it is essential to incorporate findings from other research streams. Prior research has examined critical evaluations of accounting modifications and their effects on business procedures (Burcă, Nicolăescu & Drăguţ, 2019); also, investigations have examined the stability of economic models under dynamic market circumstances (Sirghi et al., 2016). According to Tziner et al. (2020), research has also been done on the impact of organizational justice, job motivation, and emotional intelligence on workplace behavior. These findings offer insights into the human elements that affect companies. Additionally, it is becoming more widely acknowledged that a critical area for future research is the nexus between modern technologies—like artificial intelligence and data management tools—and business processes (Dabija & Vătămănescu, 2023). The need for comprehensive approaches to understanding complex business environments is further highlighted by methodological advancements like the integration of environmental, social, and governance (ESG) factors in financial performance (Bătae, Dragomir & Feleagă, 2020) and creative algorithms for data analysis (Feher et al., 2014). By analyzing the clustering of management accounting techniques inside Romanian financial and accounting service organizations and emphasizing the integration of computing, communications, and control in tackling complex organizational difficulties, this research adds to the expanding literature corpus.

The foundation that management accounting procedures provide for well-informed decision-making processes explains the strategic importance of these practices. Modern businesses must manage a complicated web of risks, uncertainties, and complexities brought on by quickly evolving market conditions and quickening technical advancements. Organizational leaders utilize management accounting techniques as guiding tools to assist steer their companies toward long-term success and growth. These techniques include cost management, budgeting, performance evaluation, and strategic planning.

Romania offers a distinctive context for this inquiry, given its current state of economic expansion and structural transformations. A combination of regional and global forces create the local business landscape, resulting in a dynamic environment where management accounting techniques may appear differently than in other contexts. In order for practitioners and policymakers to make well-informed decisions, a customized analysis of the hierarchical structures and interrelationships of these practices within the Romanian corporate environment is not only necessary but also urgent.

Management accounting procedures are essential for giving decision-makers in firms the pertinent data they need to assess employee performance and make decisions. To increase management accounting techniques' efficacy and match them with corporate objectives, it is critical to comprehend

how management accounting practices are perceived. Numerous research endeavors have examined Romanian attitudes of management accounting methods, providing insights into diverse facets of this subject matter. Albu and Albu (2006) stress the importance of more research in this area and advise focusing on the specific factors affecting the adoption and application of management accounting techniques in the Romanian setting. Furthermore, Albu and Albu (2012) offer insightful information about the variables impacting Romania's adoption and application of management accounting techniques. Organizational features that are important in the development of management accounting systems include business size, ownership structure, and industry characteristics. Additionally, a survey was carried out in Romania and Poland by Almasan et al. (2016) to examine managers' viewpoints regarding management accounting data. According to their findings, managers think that this kind of information is useful for making decisions and assessing employee performance. To pinpoint the exact types of management accounting data that are most beneficial in the Romanian context, more research is still needed (Almasan et al., 2016).

Grosu et al. (2014) investigated the state of management accounting today by examining the accountants' viewpoint on Romanian management accounting procedures. According to their research, managers see management accounting as an essential instrument for making decisions and assessing employee performance.

The 2017 study by Dabija et al. examined stakeholders' opinions about sustainability's significance at a prominent university in Romania. The findings provided new insights into management accounting procedures used in higher education. Based on their findings, stakeholders believe that management accounting procedures are essential to enhancing sustainability and accountability in higher education. Cuzdriorean (2017) carried out a field study to investigate the use of management accounting techniques with an emphasis on small and medium-sized firms (SMEs) in Romania.

Although the information provided by the current research is informative, there are still a number of knowledge gaps that need to be filled. First, given the distinctive features of the corporate environment in Romania, future research ought to examine the precise elements impacting the adoption and application of management accounting procedures in that nation (Albu & Albu, 2006). Research on the types of management accounting data that are most useful in the Romanian context is also necessary, as is an analysis of the difficulties and obstacles that organizations encounter when putting advanced management accounting techniques into practice (Almasan et al., 2016; Barbuta-Misu et al., 2023; Fein, Tziner & Vasiliu, 2023). Moreover, Dabija et al. (2017) and Cuzdriorean (2017) suggest that future research could examine how management accounting techniques support sustainability and accountability in Romanian businesses, especially in the context of SMEs and higher education institutions. These lines of investigation will advance our knowledge of the dynamics of management accounting procedures in Romanian company environments.

Although a large number of studies focus on discrete management accounting methods, there is a discernible gap in the body of research evaluating the intricate linkages and hierarchical structures that exist within certain organizational contexts.

By using hierarchical clustering analysis, a statistically sound method recognized for its ability to reveal significant patterns, this work aims to close this gap. Finding out how Romanian organizations view management accounting methods is the main goal.

This research adds to the body of knowledge regarding management accounting procedures while also providing useful information for Romanian companies. The results have potential to guide strategic choices, allocate resources, and assess performance, laying the groundwork for more efficient and situation-specific management accounting techniques. This research uses a methodologically sound technique that complies with the standards and rigor of scientific inquiry, guaranteeing the validity and trustworthiness of the insights obtained via hierarchical clustering analysis.

2 Literature review

Management accounting practices constitute a vital framework for achieving organizational objectives through systematic actions and rules (Shil, Hoque, Mahmuda, 2014). This involves leveraging accounting data to inform decision-making processes across operational, tactical, and strategic man-

agement levels. Chenhall and Langfield-Smith's (1998) survey in Australian manufacturing firms categorized traditional and contemporary management accounting practices into five functional classes, setting the stage for exploring their adoption.

Expanding the geographical scope, Abdel-Kader and Luther (2006) investigated management accounting practices in the United Kingdom, examining 38 procedures across five analytical levels, encompassing costing systems, budgeting, performance assessment, decision-making information, and strategic analysis. Similarly, Sulaiman, Ahmed, and Alwi (2004) focused on four Asian countries, revealing a preference for traditional management techniques over contemporary ones.

Within the context of the burgeoning Chinese market, Wu, Boateng, and Drury (2007) explored the uptake, perceived advantages, and prospective trajectories of Western management accounting practices in State-Owned Enterprises (SOEs) and collaborative ventures. Their study, inspired by Chenhall and Langfield-Smith's framework, covered product cost systems, budgeting, performance evaluation, planning and control, decision support systems, and responsibility accounting.

Pavlatos and Paggios (2009) underscored the impact of traditional and modern management accounting techniques on various aspects of organizational functions, specifically in the hospitality industry. Employing 30 management accounting practices within Abdel-Kader and Luther's (2006) framework, their study emphasized the multidimensional nature of these practices.

Examining the fast-food sector in Konya, Turkey, Akmese and Bayrakcı (2016) applied the taxonomy introduced by Abdel-Kader and Luther (2006). Jinga et al.'s (2010) investigation in Romania highlighted the prevalence of traditional tools in management accounting practices.

Cardos and Pete (2011) conducted an empirical study among Romanian accountants, assessing the adoption of both traditional and contemporary management accounting practices. The study concluded that Romanian companies prioritize internal concerns, such as cost calculation and management, often neglecting external factors like customer needs and market conditions.

Beyond regional contexts, Banhmeid and Aljabr (2023) emphasized the importance of employing sophisticated costing systems to enhance decision-making and organizational performance. However, their findings indicated that adopting advanced costing systems does not guarantee improvements in organizational outcomes.

The International Federation of Accountants (IFAC) provided a broader perspective, highlighting the multifaceted role of management accounting, covering budgeting, costing systems, information for decision-making, performance assessment, and strategic analysis (IFAC, 1998; IFAC, 2008). Abdel-Kader and Luther (2008) further detailed planning, control, performance measurement, evaluation, and cost management techniques within management accounting.

As organizations adapt to changing business environments, Uyar and Kuzey (2016) emphasized the need for sophisticated systems such as activity-based costing, balanced scorecard, and value chain analysis, reflecting the evolving strategic nature of management accounting practices.

Pelz's (2019) exploration of smaller companies highlighted a focus on business planning, financial accounting, and management control activities, showcasing the varied applications of management accounting across organizational sizes.

Ylä-Kujala et al.'s (2023) study reinforced the importance of management accounting in small businesses, examining its interfaces with challenges and its impact on performance.

In summary, management accounting practices constitute a dynamic and strategic set of actions encompassing diverse techniques, including costing, budgeting, performance evaluation, and strategic analysis. Scholars emphasize the complexity and adaptability of these practices in diverse organizational contexts.

Management accounting practices serve thus as critical tools in organizational decision-making, influencing strategic directions and financial outcomes. A comprehensive review of the literature reveals a rich landscape of studies examining the nuances of these practices in various organizational contexts. One prominent theoretical lens through which management accounting practices are often explored is institutional theory.

Institutional theory provides a robust framework for understanding how external pressures and normative influences shape the adoption and clustering of management accounting practices within organizations. In order to obtain credibility and guarantee their survival within their specific contexts,

organizations frequently adhere to institutional norms and expectations (DiMaggio & Powell, 1983). In the context of management accounting, this theory contends that stakeholder pressure, industry norms, and legal mandates all contribute to the institutionalization of proceduresResearch has shown that businesses commonly use management accounting practices to address concerns about efficiency as well as organizational requirements (Meyer & Rowan, 1977). The isomorphic pressures—coercive, mimetic, and normative—that institutional theory described have a substantial impact on the discipline of management accounting (DiMaggio & Powell, 1983).

The impact of coercive variables, such laws and regulations, on the adoption of specific management accounting techniques has been studied (Pfeffer & Salancik, 2003). For example, external expectations and compliance requirements may motivate the adoption of standardized cost techniques or the adherence to specific reporting formats. Mimetic pressures, arising from a desire to imitate successful organizations or industry leaders, can also influence the adoption of management accounting practices (DiMaggio & Powell, 1983). Organizations may emulate the practices of peers or competitors, leading to the diffusion of certain practices within an industry or sector.

Normative pressures, which are associated with professional standards and norms, direct firms to follow commonly recognized practices in their respective professional groups (Scott, 2008). This is particularly valid for the discipline of management accounting, where reputation and confidence are built by adherence to professional codes and industry standards.

According to Meyer and Rowan (1977), institutional theory views management accounting procedures as institutional artifacts, or symbolic objects with significance and authority inside an organizational field. Adopting specific procedures fulfills practical needs and also communicates respect to institutional rules.

In addition, the isomorphic pressures described by institutional theory are dynamic; they alter over time in response to environmental shifts (Scott, 2008). Changes in market trends, cultural expectations, or regulatory frameworks may require organizations to adapt their management accounting procedures. The literature emphasizes how institutional theory has had a major impact on how management accounting procedures are implemented today. These techniques are widely used in businesses and are closely ingrained in the institutional framework in which they function, in addition to being motivated by efficacy and efficiency concerns.

The scientific literature provides a comprehensive panorama of management accounting practices, emphasizing their crucial role in organizational success. From the foundational works of Shil, Hoque, and Mahmuda (2014) outlining the systematic actions integral to achieving objectives, to the detailed classifications offered by Chenhall and Langfield-Smith (1998) and Abdel-Kader and Luther (2006), the multifaceted nature of these practices emerges. Regional variations, as exemplified by Sulaiman, Ahmed, and Alwi (2004), and the global perspective advocated by the International Federation of Accountants (IFAC) and Uyar and Kuzey (2016).

This literature review underscores the complexity and adaptability of management accounting practices. However, the specific practices adopted by Romanian financial and accounting service companies are yet to be thoroughly examined. This study aims to address this gap by employing an institutional perspective, guided by Institutional Theory. Institutional pressures—coercive, mimetic, and normative—play a significant role in shaping the management accounting landscape (DiMaggio & Powell, 1983). This study seeks to unravel how these pressures influence the adoption and clustering of management accounting practices within Romanian financial and accounting service companies. The subsequent sections will detail the methodology employed and the findings of this investigation, contributing to the broader understanding of management accounting practices and their institutional underpinnings.

3 Methodology

This research methodology employed in this study aims to offer a robust analysis of management accounting practices within Romanian financial and accounting service companies. The 21 management accounting practices under investigation have been extracted from existing literature, reflecting a comprehensive understanding of the subject.

To analyze the complex relationships and patterns among these practices, a hierarchical clustering approach is adopted. This method provides a systematic framework for grouping similar practices based on their underlying characteristics and usage within the context of Romanian financial and accounting service companies.

The dataset, consisting of the 21 identified practices (item14.1 to item14.21), undergoes a standardization process. Standardization ensures a consistent scale, allowing for meaningful and unbiased comparisons during the clustering analysis.

The approach also emphasizes the hierarchical clustering process, an effective analytical instrument that divides practices into discrete groups according to their shared characteristics. This model's optimization is achieved by applying the Bayesian Information Criterion (BIC) value. In order to determine the most appropriate structure that best depicts the inherent connections across the management accounting methods, the hierarchical clustering algorithm is guided by the BIC metric.

To make sure the model is relevant and reliable, it is essential to validate the generated clusters. For this, a variety of metrics—including silhouette scores—are used. Silhouette scores provide a quantitative measure of how well-defined and distinct the clusters are. A higher silhouette score indicates a more accurate and reliable clustering model.

By integrating these analytical techniques and validation measures, this study ensures a methodologically thorough exploration of management accounting practices within Romanian financial and accounting service companies. The hierarchical clustering approach, complemented by optimization through BIC and validation using silhouette scores, offers valuable insights into the management accounting practices in this specific organizational context.

3.1 Participants

Convenience sampling served as the method for participant recruitment in this study, utilizing the distribution of the survey link across specialized social media networks dedicated to Romanian accountants. This facilitated a convenient and accessible means for professionals in the field to engage, ensuring a broad reach within the targeted population and leveraging the efficiency of online platforms within professional communities. However, it is crucial to acknowledge that the findings may be influenced by the self-selection bias inherent in this method, a limitation inherent in convenience sampling.

Participants were required to possess a professional background in accounting, specifically within financial and accounting service companies, and to be currently practicing as expert accountants. This criterion aimed to secure firsthand insights into the management accounting practices within their respective organizations. Ethical standards were strictly adhered to, ensuring participant confidentiality and privacy. Informed consent, outlining the study's purpose, the voluntary nature of participation, and the confidentiality of responses, was obtained from all participants.

Among the 406 participants, 68% identified as female, while the remaining 32% identified as male, reflecting a diverse and inclusive sample encompassing perspectives from both genders. The study featured participants with a diverse age range and professional experience, averaging 43 years of age. The age distribution spanned between 28 and 63 years, providing a comprehensive spectrum of experience and perspectives within the sample. From a minimum of two years to a maximum of thirty-two years, the participants showed significant professional experience in the accounting sector, with an average of twelve years of practical knowledge.

3.2 Instrument

To comprehend the management accounting landscape within the financial and accounting service companies of Romania, a robust assessment instrument is imperative. This study employs a comprehensive instrument comprising 21 items, designed to measure the implementation and utilization of various management accounting practices within this specific context. The objective is to gain insights into the nuanced application of these practices and the variability in their adoption among respondents.

The instrument is structured to capture the diverse spectrum of management accounting practices prevalent in the financial and accounting service sector. Respondents are tasked with providing ratings on a 1 to 5 Likert-type scale, where higher scores indicate a more extensive implementation of the respective practices. This scale offers a nuanced understanding of the degree to which each practice is embedded in the organizational processes of the surveyed companies.

The mean, representing the average rating, ranged across the items from 1.150 to 1.692. Standard deviation and variance values provide information about the dispersion or variability in the responses, as depicted in Table 1.

Table 1: Descriptive Statistics

	Valid	Mean	Std. Deviation	Variance
item14.1. Cost calculation through absorption-based methods	406	1.150	0.358	0.128
item14.2. Cost calculation through activity-based methods	406	1.438	0.497	0.247
item14.3. Application of the standard cost method	406	1.500	0.501	0.251
item14.4. Development of the general budget	406	1.589	0.493	0.243
item14.5. Monitoring budget execution	406	1.584	0.494	0.244
item14.6. Analysis and reporting of deviations	406	1.461	0.499	0.249
item14.7. Application of specific budgeting techniques (incremental budget, rolling budget, zero-based budget, activity-based budget)	406	1.298	0.458	0.210
item14.8. Use of financial performance indicators	406	1.650	0.477	0.228
item14.9. Use of non-financial performance indicators	406	1.456	0.499	0.249
item14.10. Use of performance reporting frameworks (dashboards, balanced scorecard)	406	1.283	0.451	0.204
item14.11. Conducting cost-volume-3 analyses	406	1.581	0.494	0.244
item14.12. Conducting sensitivity analyses	406	1.200	0.400	0.160
item14.13. Analysis of investment efficiency	406	1.495	0.501	0.251
item14.14 Analysis of customer/product/service profitability	406	1.675	0.469	0.220
item14.15. Inventory management and control	406	1.692	0.462	0.214
item14.16. Use of target cost in designing new products	406	1.335	0.473	0.223
item14.17. Use of strategic cost information in formulating the company's strategy	406	1.374	0.485	0.235
item14.18. Value chain analysis	406	1.268	0.444	0.197
item14.19. Monitoring costs incurred during the stages of product/service development	406	1.488	0.500	0.250
item14.20. Consideration of any strategic factors in pricing decisions	406	1.530	0.500	0.250
item14.21. Systematic collection of data on competitors' reactions to pricing, demand reactions, and market positioning.	406	1.502	0.501	0.251

(source: Authors own conception)

To ensure the internal consistency and reliability of the instrument, Cronbach's α was calculated. The estimate for Cronbach's α was 0.909, surpassing the commonly accepted threshold of 0.70. This high reliability coefficient (Cronbach's α) indicates a strong internal consistency among the items, affirming the instrument's capacity to measure the intended constructs effectively, namely the management accounting practices perceptions of Romanian accountants. The mean and standard deviation for the estimated Cronbach's α were 30.549 and 5.945, respectively. These values provide additional insights into the distribution of reliability estimates across multiple iterations, further confirming the

instrument's robustness.

4 Results

This study adopted a quantitative research design to investigate the management accounting practices prevalent in Romanian financial and accounting service companies. The hierarchical clustering analysis serves as the primary methodological approach, enabling a nuanced exploration of the interrelationships and patterns among these practices.

In this study, hierarchical clustering was employed to analyze the management accounting practices of 406 Romanian accountant respondents. The model's optimization was conducted with respect to the Bayesian Information Criterion (BIC) value (Akogul & Erisoglu, 2017; Zhao, Jin, L & Shi, 2015; Côme et al., 2021; Vrieze, 2012).

The utilization of hierarchical clustering allowed for the exploration of underlying patterns and structures within the dataset. The hierarchical nature of this method organizes the data into a tree-like structure, revealing relationships and similarities among the respondents' management accounting practices.

The computed coefficient of determination (R^2) in this investigation, reaching 0.364, reveals that approximately 36.4% of the variability inherent in management accounting practices can be accounted for by the identified clusters. This R^2 value indicates a moderate level of explanatory power, signifying the proficient ability of the clustering method to capture a substantial portion of the variance in respondents' perception regarding the implementation and utilization of various management accounting practices, as detailed in Table 2. The values of the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC), which were 5741.030 and 6414.100, respectively, were significant in terms of model optimization. By choosing the model with the lowest BIC value, one can ensure a judicious and effective representation of the dataset by adhering to the principles of parsimony and avoiding overfitting. The silhouette score, serving as a metric assessing the well-defined nature of the clusters, was notably recorded at 0.150. This positive silhouette score underscores a reasonable degree of separation between the clusters, providing robust support for the validity of the hierarchical clustering results. The evident distinctness and clarity of the identified clusters, as indicated by the silhouette score, augment the credibility of the clustering outcomes, affirming the reliability of the hierarchical clustering approach employed in this study.

Table 2: Hierarchical Clustering analysis

Clusters	**N**	R^2	**AIC**	**BIC**	**Silhouette**
8	406	0.364	5741.030	6414.100	0.150

Note. The model is optimized with respect to the *BIC* value.

(source: Authors own conception)

These clusters, labeled 1 through 8, vary in size and within-cluster heterogeneity, providing valuable insights into the diversity of perception regarding the implementation and utilization of various management accounting practices employed by the respondents. Cluster sizes range from 2 to 166 respondents, with the proportion of within-cluster heterogeneity explaining the variability in management accounting practices (Table 3).

Cluster 1, the largest cluster with 166 respondents, has a within-cluster heterogeneity of 36.3%, suggesting a substantial diversity of practices. Conversely, Cluster 4, consisting of only 3 respondents, exhibits a notably low within-cluster heterogeneity of 0.5%, indicating a more homogeneous set of practices within this small group. The within sum of squares represents the sum of squared Euclidean distances within each cluster. Cluster 1 has the highest within sum of squares (1964.714), reflecting the dispersion of practices within this large and diverse cluster. Cluster 7, with a within sum of squares of 14.702, shows a relatively concentrated set of practices among. The silhouette score, which assesses the coherence and separation between clusters, ranges from 0.003 to 0.212. Higher silhouette scores, such as Cluster 1's 0.212, indicate more distinct and internally consistent clusters. Conversely, Cluster

2's silhouette score of 0.038 suggests less coherence, possibly due to a mix of conflicting practices among its 95 members.

Table 3: Cluster Information

Cluster	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Size	166	95	114	3	14	7	2	5
Explained proportion within-cluster heterogeneity	0.363	0.282	0.287	0.005	0.030	0.019	0.003	0.012
Within sum of squares	1964.714	1522.251	1548.759	27.951	160.414	100.550	14.702	65.689
Silhouette score	0.212	0.038	0.143	0.125	0.176	0.071	0.165	0.073

Note. The Between Sum of Squares of the 8-cluster model is 3099.97
Note. The Total Sum of Squares of the 8-cluster model is 8505

(source: Authors own conception)

Cluster means provide a detailed view of the specific values for each management accounting practice within each cluster (Table 4). For instance, Cluster 3 displays positive values across multiple practices, indicating a strategic focus on financial performance indicators and reporting. In contrast, Cluster 4 exhibits high positive values in certain practices, potentially signifying a distinct financial strategy for the three respondents within this cluster.

The evaluation metrics, including the maximum diameter, minimum separation, Pearson's γ, Dunn index, entropy, and Calinski-Harabasz index, offer a comprehensive assessment of cluster quality (Table 5). A high maximum diameter of 8.273 indicates considerable variability among clusters, while a minimum separation of 2.828 underscores the distance between the nearest clusters. Pearson's γ, a measure of cluster separation, stands at 0.592, suggesting a moderate degree of separation between clusters. The Dunn index of 0.342 reflects the balance between cluster separation and cohesion, with higher values indicating better-defined clusters. The entropy value of 1.365 measures the unpredictability of cluster assignments, while the Calinski-Harabasz index of 32.610 signifies the overall quality of the clustering solution.

The elbow method is a visual technique used to determine the optimal number of clusters in a hierarchical clustering analysis. In this study, we applied the elbow method to the hierarchical clustering results, aiming to identify a point where the incremental gain in clustering quality diminishes, resembling an elbow in the plot. The elbow method plot would typically depict the number of clusters on the x-axis and the corresponding sum of squared Euclidean distances (within-cluster sum of squares) on the y-axis. As the number of clusters increases, the within-cluster sum of squares tends to decrease. The goal is to identify the point where the rate of decrease slows down, forming an elbow in the plot, as seen in Figure 1. The hierarchical clustering model was optimized based on the Bayesian Information Criterion (BIC) value, resulting in an optimal number of clusters set at eight.

In our analysis, the optimal number of clusters is determined by identifying the point on the plot where adding more clusters does not significantly improve the homogeneity within each cluster. This optimal number signifies a balance between capturing the diversity of management accounting practices and ensuring meaningful, interpretable clusters. The optimal number of clusters obtained from the elbow method is crucial for practical applications. If the number of clusters is too low, it might oversimplify the diversity in management accounting practices. On the other hand, an excessively high number of clusters may lead to overly specific categories with little practical significance. The elbow method aids in striking a balance, ensuring that the identified clusters are both distinct and meaningful. The choice of eight clusters implies that, according to the elbow method analysis, this configuration maximizes within-cluster homogeneity while avoiding the diminishing returns associated with additional clusters. From a practical perspective, this indicates that eight separate clusters can best describe the management accounting procedures of Romanian financial and accounting service organizations.

Table 4: Cluster Means

	item 14.1	item 14.2	item 14.3	item 14.4	item 14.5	item 14.6	item 14.7	item 14.8	item 14.9	item 14.10	item 14.11
Cluster 1	-0.336	-0.385	-0.385	-0.547	-0.585	-0.549	-0.467	-0.529	-0.636	-0.534	-0.628
Cluster 2	-0.067	-0.035	-0.116	0.215	0.268	0.047	-0.375	0.358	0.163	-0.255	0.379
Cluster 3	0.438	0.601	0.631	0.764	0.755	0.782	0.901	0.604	0.722	0.733	0.599
Cluster 4	2.375	-0.212	0.333	-1.195	-1.183	-0.923	-0.651	-0.664	-0.245	0.111	0.173
Cluster 5	-0.220	0.124	0.143	-0.905	-0.893	-0.923	-0.495	-0.315	-0.054	0.797	0.414
Cluster 6	-0.021	-0.020	0.143	0.255	0.554	1.081	1.221	-0.464	1.092	1.272	-0.020
Cluster 7	2.375	-0.882	0.000	0.835	-0.170	1.081	1.533	0.732	0.089	1.589	-1.177
Cluster 8	0.698	-0.077	-0.200	-0.789	-0.372	0.680	1.533	-1.362	0.289	1.145	-0.772

	item 14.12	item 14.13	item 14.14	item 14.15	item 14.16	item 14.17	item 14.18	item 14.19	item 14.20	item 14.21
Cluster 1	-0.484	-0.652	-0.604	-0.442	-0.645	-0.723	-0.537	-0.649	-0.831	-0.667
Cluster 2	-0.314	0.062	0.536	0.256	-0.397	-0.186	-0.344	0.077	0.520	0.405
Cluster 3	0.773	0.851	0.525	0.533	1.017	1.038	0.759	0.813	0.678	0.591
Cluster 4	-0.499	-0.989	-1.439	0.666	-0.003	1.291	1.649	0.358	0.274	-0.338
Cluster 5	0.394	0.866	0.541	0.512	1.407	1.291	1.488	0.881	0.941	0.423
Cluster 6	2.001	-0.704	-1.134	-1.497	0.198	0.112	1.005	-0.404	-0.202	0.423
Cluster 7	-0.499	-0.989	-0.373	-1.497	0.349	0.259	1.649	1.024	-0.059	0.994
Cluster 8	1.001	0.609	-1.013	-1.497	1.407	-0.773	-0.154	-0.974	-0.259	-1.004

(source: Authors own conception)

Table 5: Evaluation Metrics

	Value
Maximum diameter	8.273
Minimum separation	2.828
Pearson's γ	0.592
Dunn index	0.342
Entropy	1.365
Calinski-Harabasz index	32.610

Note. All metrics are based on the *Euclidean* distance.

(source: Authors own conception)

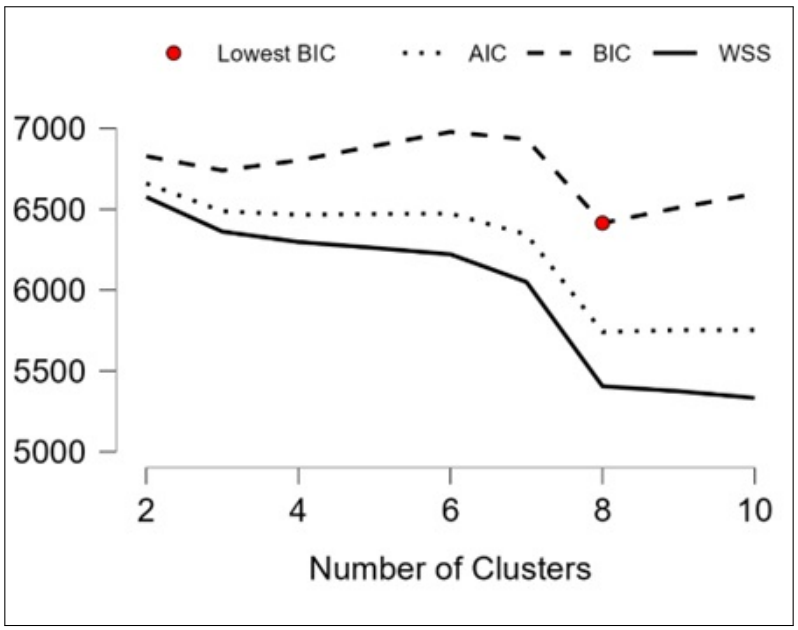

Figure 1: Elbow Method Plot

For visualizing high-dimensional data in lower-dimensional space, dimensionality reduction techniques like t-SNE (t-distributed Stochastic Neighbor Embedding) are frequently used. The multidimensional links among the 21 management accounting practices are illustrated by the t-SNE cluster plot shown in Figure 2, which is within the context of hierarchical clustering with eight clusters.

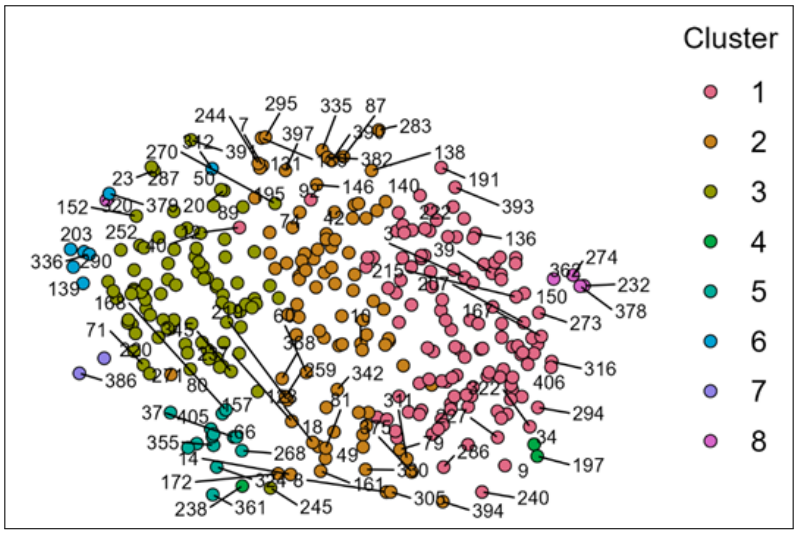

Figure 2: t-SNE Cluster Plot

The t-SNE cluster plot presents each data point, representing a management accounting practice, positioned in proximity to other practices with similar characteristics. The eight clusters identified through hierarchical clustering manifest as distinct groupings or patterns in the t-SNE plot. Practices within the same cluster are spatially close, indicating their similarity, while practices from different clusters appear more distant.

The well-defined and visually distinct clustering pattern reinforces the validity and relevance of the hierarchical clustering results. It also provides a visual narrative of how certain management accounting practices tend to co-occur or exhibit similarities within the Romanian financial and accounting service sector.

The hierarchical clustering analysis in this study thus provides a robust and optimized model for understanding the patterns and relationships within the respondents' perception regarding the implementation and utilization of various management accounting practices.

5 Discussion and implications

The hierarchical clustering analysis conducted in this study revealed eight distinct clusters of management accounting practices within Romanian financial and accounting service companies. Each cluster exhibited unique characteristics, as evident from the variations in size, explained proportion of within-cluster heterogeneity, within sum of squares, and Silhouette scores. These findings offer a nuanced understanding of the diverse landscape of management accounting practices in the Romanian business context.

The results highlight the Romanian accountant's perception of management accounting practices, indicating that certain practices tend to co-occur within specific groups of companies. This clustering provides insights into the commonalities and variations in the adoption of these practices, offering a foundation for a more targeted understanding of the dynamics at play in the Romanian business environment.

Drawing on recent advancements in organizational behaviour and management theory, particularly the institutional theory (Amenta & Ramsey, 2010; Lammers et al., 2014; Kostova, Roth & Dacin, 2008) our study contributes to the literature by illuminating how institutional pressures and normative influences may shape the adoption and clustering of management accounting practices within Romanian companies. Institutional theory posits that organizations conform to institutional norms and expectations to enhance legitimacy and ensure organizational survival -(Peters, 2011).

The observed clusters may reflect the influence of institutional pressures on the selection and adoption of management accounting practices, similar to other research findings (Ribeiro & Scapens, 2006; Guerreiro, Pereira & Frezatti, 2006; Scapens, 2006; Hassan, 2005; Arroyo, 2012). For instance, companies within a specific cluster may conform to industry norms or regulatory expectations, leading to a cohesive set of practices within that cluster. The institutional theory lens allows us to understand how external forces shape the internal practices of organizations, providing a framework for comprehending the observed clustering patterns. This aligns with insights from other studies that have explored collaborative decision-making frameworks (Filip, 2022) and the integration of advanced technologies in financial decision-making (Ionescu & Diaconita, 2023), as well as energy-efficient clustering protocols in different contexts (Kumar et al., 2011).

Discerning the distinct clusters and their attributes carries tangible benefits for companies and policymakers in the financial and accounting service sector. Companies can utilize this insight for benchmarking their management accounting practices against industry peers within the same cluster, pinpointing areas for enhancement or optimization. This facilitates a strategic approach to refining financial processes. Policymakers, armed with these findings, can tailor regulations and guidelines to align with the prevailing practices in specific clusters, promoting a more focused and effective regulatory framework.

Moreover, the outcomes of this study hold practical implications for both academic and practitioner realms in the financial and accounting service sector. The diverse patterns of management accounting practices elucidated herein can guide curriculum development for accounting education and training programs, ensuring alignment with industry trends. For practitioners, these insights serve as a valuable resource for enhancing strategic decision-making and customizing management accounting practices to suit the nuances of their specific organizational contexts, thereby optimizing overall financial processes.

6 Conclusion and limitations

This study's hierarchical clustering analysis provides a thorough understanding of the management accounting practices prevalent in Romanian financial and accounting service firms. After analysing twenty-one different practices, we were able to identify eight clusters, each with its own set of characteristics and implications. This study reveals a great deal of variability in the clusters, both in size and within-cluster heterogeneity. An in-depth grasp of the co-occurrence of particular management accounting methods implementation perception is provided by the analysis of each cluster. The observed variability within the clusters highlights the complex nature of management accounting approaches in the context of Romanian industry.

Using institutional theory as a theoretical framework provides a solid basis for analysing the study's results. The clusters that have been identified are presumably indicative of the ways in which normative and institutional factors impact the choice and application of management accounting practices. Organizations in a given cluster may conform to industry norms, legal requirements, or external expectations, demonstrating the important influence that institutions have on internal behaviour.

The study's conclusions provide directions for more investigation. It is advised that more research be done on the variables affecting the development and outcomes of management accounting practice clusters. Professionals in academia and business could benefit greatly from an investigation into how these clusters develop over time, especially in reaction to modifications in external surroundings, laws, and industry trends.

This study does, however, have some limitations. The cross-sectional approach makes it more difficult to determine connections between variables, and the results might not be generalizable outside of the Romanian financial and accounting services industry. Longitudinal studies and wider geographic scopes could be advantageous for future research to have a more thorough grasp of global management accounting methods. Furthermore, using qualitative research techniques may offer more in-depth understanding of the particular organizational procedures that promote the uptake and use of management accounting techniques.

The findings of this study serve to both motivate and lay the groundwork for future research projects that will deepen our understanding of management accounting procedures in the particular professional and geographic context that is being studied.

References

[1] Abdel-Kader, M., Luther, R. (2006). Management accounting practices in the British food and drinks industry. British Food Journal, 108(5), 336-357.

[2] Abdel-Kader, M., Luther, R. (2008). Management accounting practices. British Journal of Management, 19(3), 205-223.

[3] Akmese, H., Bayrakcı, S. (2016). A Research on Use of Management Accounting Tools and Techniques in Fast Food Operations: The Case of Konya. RSEP International Conferences on Social Issues and Economic Studies.

[4] Akogul, S., Erisoglu, M. (2017). An approach for determining the number of clusters in a model-based cluster analysis. Entropy, 19(9), 452.

[5] Albu, C. N., Albu, N. (2006). Some Directions for Management Accounting Research in Romania. Journal of Accounting and Management Information Systems, Supplement, 300-399.

[6] Albu, N., Albu, C. N. (2012). Factors associated with the adoption and use of management accounting techniques in developing countries: The case of Romania. Journal of International Financial Management & Accounting, 23(3), 245-276.

[7] Alhato, O. (2023). The impact of management accounting practices: Comparative analysis study between Jordan and Romania. Theoretical and Applied Economics, 30(3 (636), Autumn), 297-304.

[8] AlMaryani, M. A. H., Sadik, H. H. (2012). Strategic management accounting techniques in Romanian companies: Some survey evidence. Procedia Economics and Finance, 3, 387-396.

[9] Almasan, A., Circa, C., Dobroszek, J., Zarzycka, E. (2019). The assessed usefulness of management accounting in Romania and Poland: a comparative contingency-based study. Engineering Economics, 30(3), 253-264.

[10] Almasan, A., Circa, C., Zarzycka, E., Dobroszek, J. (2016). Management accounting information from the perspective of managers: the case of Poland and Romania Selected findings of a survey research. Zeszyty Teoretyczne Rachunkowości, (90 (146), 41-64.

[11] Amenta, E., Ramsey, K. M. (2010). Institutional theory. Handbook of politics: State and society in global perspective, 15-39.

[12] Arroyo, P. (2012). Management accounting change and sustainability: an institutional approach. Journal of Accounting & Organizational Change, 8(3), 286-309.

[13] Banhmeid, B., Aljabr, A. (2023). The relationship between the role of management accountants, advanced manufacturing technologies, cost system sophistication and performance: a path model. Journal of Financial Reporting and Accounting. DOI: 10.1108/JFRA-01-2023-0047.

[14] Barbuta-Misu, N., Dinu, V., Madaleno, M., Virlanuta, F. O., Man, O. R., Badiu (Cazacu), C. E. (2023). A sectoral investigation of factors affecting firms' financial performance in EU countries. Transformations in Business & Economics, 22(2), 274.

[15] Bătae, O. M., Dragomir, V. D., Feleagă, L. (2020). Environmental, social, governance (ESG), and financial performance of European banks. Accounting and Management Information Systems, 19(3), 480-501.

[16] Burcă, V., Nicolăescu, C., Drăguţ, D. (2019). Critical analysis on the amendments discussed, concerning changes in accounting estimates. Studies in Business and economics, 14(1), 17-33.

[17] Calu, D. A., Dumitru, M., Dumitru, V. F., Jinga, G. (2017). The change drivers in the management accounting in Romania. Transformations in Business & Economics, 16(2).

[18] Cardos, I., Pete, S. (2011). Managerial and cost accounting practices - a Romanian overview. Annals of Faculty of Economics, 1, 484-490.

[19] Chenhall, R., Langfield-Smith, K. (1998). Factors influencing the role of management accounting in the development of performance measures within organizational change programs. Management Accounting Research, 9, 361-386.

[20] Côme, E., Jouvin, N., Latouche, P., Bouveyron, C. (2021). Hierarchical clustering with discrete latent variable models and the integrated classification likelihood. Advances in Data Analysis and Classification, 15(4), 957-986.

[21] Cuzdriorean, D. D. (2017). The use of management accounting practices by Romanian small and medium-sized enterprises: A field study. Journal of Accounting and Management Information Systems, 16(2), 291-312.

[22] Dabija, D. C., Vătămănescu, E. M. (2023). Artificial intelligence: The future is already here. Oeconomia Copernicana, 14(4), 1053-1056.

[23] Dabija, D. C., Postelnicu, C., Dinu, V., Mihăilă, A. (2017). Stakeholders' perception of sustainability orientation within a major Romanian University. International Journal of Sustainability in Higher Education, 18(4), 533-553.

[24] DiMaggio, P. J., Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48(2), 147-160.

[25] Feher, K., Kirsch, J., Radbruch, A., Chang, H. D., Kaiser, T. (2014). Cell population identification using fluorescence-minus-one controls with a one-class classifying algorithm. Bioinformatics, 30(23), 3372-3378.

[26] Fein, E. C., Tziner, A., Vasiliu, C. (2023). Perceptions of ethical climate and organizational justice as antecedents to employee performance: The mediating role of employees' attributions of leader effectiveness. European Management Journal, 41(1), 114-124.

[27] Filip, F. G. (2022). Collaborative Decision-Making: Concepts and Supporting Information and Communication Technology Tools and Systems. International Journal of Computers Communications & Control, 17(2), Article 4732. https://doi.org/10.15837/ijccc.2022.2.4732

[28] Grosu, C., Almasan, A., Circa, C. (2014). The current status of management accounting in Romania: the accountants' perception. AMIS 2014, 15.

[29] Guerreiro, R., Pereira, C. A., Frezatti, F. (2006). Evaluating management accounting change according to the institutional theory approach: a case study of a Brazilian bank. Journal of Accounting & Organizational Change, 2(3), 196-228.

[30] Hassan, M. K. (2005). Management accounting and organisational change: an institutional perspective. Journal of Accounting & Organizational Change, 1(2), 125-140.

[31] IFAC. (1998). Management accounting concepts: International Management Accounting Practice Statement. IFAC, New York, NY.

[32] IFAC. (2008). International Management Accounting Practice Statement. IFAC, New York, NY.

[33] Ionescu, S. A., Diaconita, V. (2023). Transforming financial decision-making: The interplay of AI, cloud computing, and advanced data management technologies. International Journal of Computers Communications & Control, 18(6), Article 5735. https://doi.org/10.15837/ijccc.2023.6.5735

[34] Jinga, G., Dumitru, M., Dumitrana, M., Vulpoi, M. (2010). Accounting systems for cost management used in the Romanian economic entities. Accounting and Management Information Systems, 9(2), 242-267.

[35] Kostova, T., Roth, K., Dacin, M. T. (2008). Institutional theory in the study of multinational corporations: A critique and new directions. Academy of management review, 33(4), 994-1006.

[36] Kumar, D., Aseri, T. C., Patel, R. B. (2011). EECDA: energy efficient clustering and data aggregation protocol for heterogeneous wireless sensor networks. International Journal of Computers Communications & Control, 6(1), 113-124.

[37] Lammers, J. C., Garcia, M. A., Putnam, L. L., Mumby, D. K. (2014). Institutional theory. The SAGE handbook of organizational communication: advances in theory, research, and methods, 195-216.

[38] Meyer, J. W., Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. American Journal of Sociology, 83(2), 340-363.

[39] Pavlatos, O., Paggios, I. (2009). Management Accounting Practices in the Greek Hospitality Industry. Managerial Auditing Journal, 24(1), 81-98.

[40] Pelz, M. (2019). Can management accounting be helpful for young and small companies? Systematic review of a paradox. International Journal of Management Reviews, 21(2), 256-274.

[41] Perkhofer, L. M., Hofer, P., Walchshofer, C., Plank, T., Jetter, H. C. (2019). Interactive visualization of big data in the field of accounting: A survey of current practice and potential barriers for adoption. Journal of Applied Accounting Research, 20(4), 497-525.

[42] Peters, B. G. (2011). Institutional theory. The SAGE handbook of governance, 78-90.

[43] Pfeffer, J., Salancik, G. R. (2003). The external control of organizations: A resource dependence perspective. Stanford University Press.

[44] Réka, C. I., Ştefan, P. (2011). Managerial and cost accounting practices–a Romanian overview. European Integration New Challenges Conferece Proceedings, 1263-1269.

[45] Ribeiro, J. A., Scapens, R. W. (2006). Institutional theories in management accounting change: contributions, issues and paths for development. Qualitative research in accounting & management, 3(2), 94-111.

[46] Scapens, R. W. (2006). Understanding management accounting practices: A personal journey. The British Accounting Review, 38(1), 1-30.

[47] Scott, W. R. (2008). Institutions and Organizations: Ideas, Interests, and Identities. Sage Publications.

[48] Shil, N. Ch., Hoque, M., Mahmuda, A. (2014). Management accounting today: A perspective for tomorrow. Asia-Pacific Management Accounting Journal, 9(2), 37–68.

[49] Sirghi, N., Mircea, G., Neamţu, M., Cismaş, L. M., Haţegan, C. (2016). Stability analysis of some dynamical models for prices with distributed delays. Economic Computation & Economic Cybernetics Studies & Research, 50(3), 135-152.

[50] Sulaiman, Maliah bt. Ahmad, Nik Nazli Nik, Alwi, Norhayati (2004). Management accounting practices in selected Asian countries. Managerial Auditing Journal, 19(4), 493 – 508.

[51] Tziner, A., Fein, E. C., Kim, S. K., Vasiliu, C., Shkoler, O. (2020). Combining associations between emotional intelligence, work motivation, and organizational justice with counterproductive work behavior: A profile analysis via multidimensional scaling (PAMS) approach. Frontiers in Psychology, 11, 851.

[52] Uyar, A., Kuzey, C. (2016). Does management accounting mediate the relationship between cost system design and performance? Adv. Account., 35, 170-176.

[53] Vrieze, S. I. (2012). Model selection and psychological theory: a discussion of the differences between the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). Psychological methods, 17(2), 228.

[54] Wu, J., Boateng, A., Drury, C. (2007). An analysis of the adoption, perceived benefits, and expected future emphasis of western management accounting practices in Chinese SOEs and JVs. The International Journal of Accounting, 42(2), 171-185.

[55] Ylä-Kujala, Antti Kouhia-Kuusisto, Kati Ikäheimonen, Tuuli Laine, Teemu, Kärri, Timo. (2023). Management accounting adoption in small businesses: interfaces with challenges and performance. Journal of Accounting & Organizational Change, 19, 46-69.

[56] Zhao, J., Jin, L., Shi, L. (2015). Mixture model selection via hierarchical BIC. Computational Statistics & Data Analysis, 88, 139-153.

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