

Codifying and Validating Management Accounting Practices Measurement Using Content Analysis and Word Embedding Model Using Word2Vec Method¹

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Received: 2024/07/01
Accepted: 2024/08/13

Research Paper

INTRODUCTION

In today's competitive and complex world, having financial accounting information and mastering management knowledge and decision-making skills are essential. The success of any organization depends on its ability to identify and respond to its problems. Many companies are forced to use management accounting tools to improve the quality of their products and services, control and evaluate performance, and reduce the cost of production to survive in competitive markets. Management accounting practices have now become multidisciplinary management tools that include a chain of practical techniques for generating accurate information that helps businesses make more informed decisions to develop and implement corporate strategies more effectively and efficiently than ever before. As such, it can be argued that management accounting practices play a key role in business management in the developed world.

1. doi: 10.22051/jera.2024.47623.3267

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Iran is entering the global competitive market as a developing country. To be successful in these markets, it is necessary to have a high level of competitiveness. Therefore, Iranian companies must make the necessary and sufficient changes in their strategies and activities and develop long-term strategies and move forward with long-term planning. Changes in the duties, skills, and tools of management accountants are one of these fundamental changes. Having relevant, accurate, correct, and reliable information is one of the most important elements of decision-making, and since management accountants provide the information that management needs, paying attention to management accountants is one of the most important factors in creating competitiveness.

The purpose of designing management accounting practices is to achieve continuous improvement and ultimately achieve organizational goals. Although previous research has provided extensive evidence on the adoption of management accounting practices, empirical research on management accounting practices has been limited due to the lack of data with sufficient statistical power.

Previous research has provided extensive evidence on the adoption of management accounting practices. However, empirical research on management accounting practices remains in its infancy due to the lack of high-quality publicly available data. In addition, a review of the management accounting research literature reveals that these studies have primarily used survey instruments, which inherently have limitations due to potential biases arising from low response rates and respondents' subjective opinions. To address these research gaps, this study aims to develop new and valid textual metrics for management accounting practices from a holistic and large-scale perspective. Moreover, given the critical role of management accounting within organizations and the shift in recent decades from cost accounting to value creation, management accounting units are also expected to grow and adapt to the needs of the organization's size, nature, activities, level of culture, and characteristics in

line with the volume of business. But how can one design a management accounting unit that is tailored to the organization and has an approach to improvement and value creation? The answer to this question lies in the design of management accounting metrics and practices in organizations. If it is possible to integrate the global principles of management accounting with the fields of action of management accounting and to show in practice where the organization currently stands and how far it is from the desired state, we have opened the way for the architecture of the management accounting unit. Therefore, this study was conducted with the primary objective of investigating the extent of the use of management accounting practices in organizations and developing textual metrics for management accounting practices. Based on this objective, the following questions are raised:

- How can management accounting practice metrics be developed from publicly disclosed company reports?
- How are the validity and reliability of the developed metrics assessed?
- Can the developed metrics be explained by an objective industry benchmark?

MATERIALS AND METHODS

This research is applied in terms of purpose and descriptive-analytical in terms of research method. In other words, in presenting the results, the descriptive method will be used for the sample, and the inductive inference method will be used in generalizing the results to the statistical population. In this research, first, by reviewing previous research on management accounting procedures and concepts and studying the companies' disclosure reports, a collection of words related to management accounting procedures will be collected. Then, through interviews with academic and professional experts in the field of management accounting, criteria for measuring the textual content of management accounting procedures will

be developed and validated. In addition, a set of other validations, including convergence, distinction, continuity, and reliability, will be performed to ensure that the criteria for measuring management accounting procedures are truly reflective of companies' actual choices.

According to Qiu et al. (2023), this research focuses on seven management accounting procedures: cost, investment, budgeting, operations, performance, strategy, and risk. With the assumption that companies have the motivation to disclose management accounting information in corporate reports to communicate with stakeholders, criteria for measuring the textual content of management accounting procedures are developed at the company level among companies listed on the Tehran Stock Exchange with a content analysis approach of Word2Vec by creating a dictionary for management accounting procedures. The creation of the management accounting procedures dictionary includes three steps: (1) selection of appropriate initial words; initial words are selected through a literature review of previous research on management accounting procedures and concepts and interviews with academic and professional experts. (2) expansion of initial words by finding synonyms using the Word2Vec method; and (3) scoring of management accounting procedures based on the weighted word frequency in annual reports. To ensure the validity and reliability of the developed management accounting procedures measurement criteria, a set of validations, including content, convergence, distinction, continuity, and reliability, has been performed.

RESULTS AND DISCUSSION

The prerequisite for choosing keywords is to clarify the scope of the concept of the dimensions of management accounting procedures. The dimensions and concepts of management accounting procedures are derived from the principles of global management accounting (issued by the Certified Global Management Accountant (CGMA)). Some of the results of keywords and synonyms are described in Table 1:

Table 1. synonyms and Keywords

Dimensions	Key words	Synonymous words
price	Cost control, final cost, total cost, cost management, production cost, activity-based costing, target-based pricing, variable cost, initial cost	Increase income and decrease cost, increase production and decrease cost, initial price, cost price, cost management, cost factors, sales process and cost price, cost analysis, cost management and cost optimization, cost optimization, cost monitoring, life cycle, cost leadership, cost organization, cost system, input price, target based pricing, cost reduction, cost performance control, optimal management of resources, cost management, value engineering, new systems Management accounting, production costs, variable cost, final cost, activity-based costing
investment	Equity investment, financing, joint venture, optimization, financial investment	Investment activities, acquisition of long-term investments, acquisition of short-term investments, cash flows resulting from investment activities, investment ratios, investment opportunities, investment fund, investment funds investment, optimization, financing, financing development, financing resources, financing activities, financing costs, working capital, changes in working capital, international investment, investment concentrated, financial investment, joint investment, investment in stocks, investments in securities
budget	Projected budget, company budget, financial forecast, budget deficit, production plan forecast, cash budget, budgeting	Comprehensive budgeting, operational budget, adjusted budget, projected budget, projected plans, production budget, planning and budget, capital budget, company budget, annual budget, budget information, forecast production, budget plan Comparison of budget and actual performance, annual budget, sales budget, approved budget, budget realization, cash budget, fiscal year forecast, budget forecast, forecasted profit, forecasted cash flows, income statement and budget loss, income forecast, profit per share forecast, sales forecast, budget deduction, budgeted sales, budget deficit, budget reporting
operation	Production capacity, production statistics, production technology, price changes, activity ratios, capacity	Nominal capacity, empty capacity, Kanban, waste reduction, fuel and waste reduction, kaizen, JIT, TQM, production efficiency improvement, production capacity increase, production feasibility, production statistics, production and sales statistics, comparative production statistics, planning and management Production, product quality improvement, continuous improvement, production efficiency, productivity increase, capital efficiency, productivity improvement,

Dimensions	Key words	Synonymous words
	<p>increase, product improvement, price elasticity</p>	<p>resource efficiency, sustainable supply, sustainable production, quality assurance, price changes, percentage of price changes, production technology, new product development, product production New, lean production, margin of safety, operation turnover period, goods turnover period, product quality evaluation index, six sigma, identification and elimination of losses, price elasticity, effective control, control of production schedule and orders, operation control, inventory control, production management, Knowledge management, knowledge management development, business management, quality management, total quality management, liquidity management, cash flow management, mechanization of business processes, basic engineering, product re-engineering, process re-engineering, activity ratios, point-to-point head, head-to-head sales, product innovation and development, production capacity</p>
<p>performance</p>	<p>Financial performance, social performance, financial status, added value, rate of return, employee performance, transaction status, actual performance, market share, financial ratios, employee training, sustainability report</p>	<p>Added value, performance evaluation, BSC, KPI, return on equity, Sales efficiency, Sales efficiency percentage, return on total assets, company sustainability, quality sustainability, profit sustainability, sustainability in the market, human resource empowerment, human resource development and empowerment, human capital empowerment, the company's position in the industry, the company's position in the market, market share, production efficiency indicators, key performance indicators, social performance, employee performance, balanced scorecard, accounts receivable turnover, effective market management, effective liquidity management, effective cost management, human resource management, Current ratio, debt-to-equity ratio, interest expense coverage ratio, financial expense coverage ratio, current ratio, quick ratio, net profit to sales ratio, retained earnings to sales ratio, equity ratio, leverage ratios, debt ratios, profitability ratios, Financial ratios, liquidity ratios, employee training system, employee training and improvement system, new management systems, financial situation</p>
<p>strategy</p>	<p>Governance system, company development, company's plans, policy</p>	<p>Organizational ethics and behavior, compliance with professional and organizational ethics, value creation, value creation for shareholders, sustainable value creation, value creation for stakeholders, product development and differentiation strategy, market penetration and development, productivity growth</p>

Dimensions	Key words	Synonymous words
	making, planning, corporate governance, value chain, strategy	strategy, cost leadership strategy, establishment of monitoring system, Strategic goals, formulation of strategic goals, management goals, marketing, strategic planning and management, strategic planning, Development plan, planning and development, company plan and development plan, planning, future plans of the company, improvement of company processes, swot analysis, strengthening the supply chain, strengthening the brand, focusing on strategic target markets, human resources empowerment, supply chain development, chain development value, human capital development, market share development, production capacity development, business development, organization learning development, organization agility, vision realization, plans and vision of the company's status, corporate governance principles, corporate governance guidelines, corporate governance system, creating value from data, company management system, brand development, customer orientation, work environment grooming system, innovation in business, being a leader and innovation in business
risk	Risk analysis, risk of interest rate fluctuations, risk of product quality, risk of exchange rate fluctuations, risk of production input prices, risk of international factors and government regulations, risk identification, political risk, risk committee	Risk analysis, investment risk analysis, balance sheet risk analysis, risk tracking, risk of non-payment of claims on the due date, risk of entry of new competitors, safety risk, project risk, risk of supply of production inputs, risk of changing laws, Legal risk, production risk, product price reduction risk, product price risk, auditor's report risk, reporting risk, human resources risk, strategic risk, credit risk, risk of customers favoring alternative products, compliance risk, market risk, product sales market risk, Raw material supply risk, raw material risk, commercial risk, oppressive sanctions risk, price change risk, economic recession risk, profitability risk, political risk, political and legal risk, industry risk, operational risk, risk of international factors and government regulations, product sales risk, product sales rate risk, energy carrier price risk, energy carrier rate increase risk, production input price risk, product quality risk, financial risk, interest rate risk, inflation rate risk, inflation risk, liquidity risk

Regression results of convergent validity of matching the measurement criteria with the proven indicators of each of the dimensions of

management accounting practices with controlling variables of Size and ROA are as described in Table 2:

Table 2. Regression results of convergent validity

Dimension	Gross profit Margin	Investment activities Cashflow	Budget Presentation	Inventory turnover	P/BV	Current Ratio	Formation of Risk Committee
Cost	1.748 (0.0232)						
Investment		-6.448 (0.0045)					
Budget			969.24 (0.000)				
Operation				29.124 (0.000)			
Performance					397.504 (0.0006)		
Strategy						-9.99 (0.0010)	
Risk							838.28 (0.000)
Size	0.002 (0.0212)	-0.010 (0.0012)	-0.004 (0.941)	-0.2103 (0.000)	1.487 (0.000)	0.0006 (0.9761)	0.978 (0.000)
ROA	0.073 (0.000)	0.020 (0.0620)	-0.064 (0.853)	-0.264 (0.000)	12.692 (0.000)	2.055 (0.000)	1.419 (0.0005)
R ² / McFadden R ^y	0.970	0.221	0.057	0.850	0.359	0.86	0.188

As seen in Table 2, the convergent validity of price dimensions with gross profit margin (with a p-value of 0.0232) at the 95% confidence level, investment with cash flows from investment activities (with a p-value of 0.0045) at the 99% confidence level, budget with budget presentation (with a p-value of 0.000) at the 99% confidence level, operations with inventory

turnover (with a p-value of 0.003) at the 99% confidence level, performance with price to book value (with a p-value of 0.0006) at a 99% confidence level, strategy with a current ratio (with a p-value of 0.001) at a 99% confidence level and risk with the formation of a risk committee (It is confirmed with a p-value of 0.000) at the 99% confidence level.

CONCLUSION

This study develops scale-based metrics from a comprehensive and large sample of management accounting practices using the Word2vec word representation model to extract management accounting practice-related words in annual reports and score management accounting practices as weighted word frequencies. This approach utilizes the power of natural language processing to quantify management accounting practices from qualitative information disclosed in annual reports and can capture the textual meaning of words. Unlike manual identification of accounting terms and practices, Word2Vec can automatically identify keywords and phrases related to management accounting practices, even when the language used is not standardized or explicit, thereby enabling more accurate and objective measurement of management accounting practices. A review of the prior literature shows that traditional management accounting metrics often rely on quantitative financial data. However, qualitative information disclosed in annual reports and other textual sources can provide valuable insights into a company's management accounting practices. In this study, by applying the Word2Vec model to textual data in companies' annual reports, more comprehensive and nuanced metrics of management accounting practices are developed. In addition, the developed management accounting practice measurement metrics are evaluated and validated from the perspective of content, convergent, distinction, continuity, and reliability.

The development and validation of management accounting practice measurement metrics help companies compare their performance with their overall strategy and identify strengths and weaknesses. These measurement metrics assist management in strategic decision-making and

practice improvement, thereby contributing to the company's growth and development.

The textual management accounting practices metrics provide a platform for directly assessing company-level management accounting practices and are valuable for future research opportunities that require dynamic measures of company-level management accounting practices. Additionally, these multi-dimensional management accounting practices metrics enable management accounting researchers to comprehensively test empirical hypotheses regarding the interdependencies between management accounting practices.

Keywords: Content Analysis, Management Accounting Practices, Word Embedding, Word2Vec.

JEL Classification: M00, M41.

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