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Bibliometric Analysis of the Quality of Management Control System Using Delone and McLean Model

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Abstract

Purpose: This bibliographic analysis explores the literature on measuring the quality of Management Control Systems (MCS) using the Delone and McLean Model.

Design/methodology/approach: This study utilized a bibliometric analysis using data sourced from the Scopus database. By focusing on keywords related to management control system and the Delone and McLean Model in the article titles, the study identified 106 documents for in-depth examination. The analysis was conducted using various tools: Microsoft Excel for frequency analysis, VOSviewer for data visualization, and Harzing's Publish or Perish for citation metrics and analysis.

Findings: The historical evolution of quality of MCS and ethical considerations provides a backdrop for understanding this relationship, highlighting key milestones and shifts in research focus over time. Through critical analysis, common themes, methodologies, and trends in the literature are identified, alongside discussions of strengths, limitations, and gaps in existing research. Synthesizing insights from diverse perspectives, this analysis elucidates the complex interplay between MCS, considering factors such as organizational culture, leadership, and regulatory environments.

Research limitations/implications: The limitations of this bibliographic analysis include the potential exclusion of relevant studies not indexed in databases, variations in the quality of literature analyzed, and the challenge of establishing clear causal relationships in complex organizational contexts. Additionally, publication bias may skew the overall understanding of the relationship between MCS quality and ethical conduct, while the dynamic nature of both MCS and ethical considerations underscores the need for ongoing research to capture evolving trends and emerging challenges.

Practical implications: Practical implications for organizations seeking to enhance ethical conduct through quality of MCS are discussed, alongside recommendations for future research directions. Ultimately, this study underscores the importance of understanding and addressing ethical challenges within contemporary organizations, offering insights to inform both theory and practice in the field of management and ethics.

Originality/value: This bibliographic analysis provides a concise synthesis of existing research on the relationship between Management Control Systems (MCS) quality and ethical conduct, offering fresh insights and identifying key trends and gaps in the literature. Its value lies in guiding future research efforts and informing the development of strategies to promote ethical behavior within organizations.

Keywords: Bibliometric Analysis, Management Control System, MCS, Quality, Ethical Conduct

Introduction

In the contemporary business environment, Management Control Systems (MCS) have evolved significantly with the advent of advanced technologies. Modern MCS utilize sophisticated tools and platforms to enhance their effectiveness in guiding managerial behaviour. The quality of MCS is paramount, directly influencing the effectiveness of these systems through their robustness, adaptability, and ability to provide accurate and timely information—crucial for maintaining the integrity of financial reporting and corporate governance. The Malaysian Code of Corporate Governance (2021) underscores the significance of robust and high-quality MCS in achieving key governance principles.

A Management Control System is a set of processes, tools, and techniques that help managers monitor and control organizational activities, ensuring alignment with organizational goals and objectives. The quality of an MCS is vital to an organization's overall performance and success. There is growing interest in how MCS quality impacts organizational performance. One perspective on MCS quality is provided by DeLone and McLean (1992), which emphasizes a comprehensive and integrated system encompassing various aspects of management control. DeLone and McLean argue that a high-quality MCS should incorporate quality-based metrics to evaluate workforce performance. They also suggest that integrating quality improvement and manufacturing system management can further enhance MCS effectiveness. This perspective highlights the need for a holistic approach to MCS quality (Iakovou & Ortiz, 2003).

The DeLone and McLean Information Systems (IS) Success Model underscores the importance of system quality, information quality, and service quality as fundamental components for evaluating MCS effectiveness. Focusing on MCS quality through this model allows for a comprehensive understanding of how these systems contribute to organizational success. High-quality MCS ensures accurate, timely, and relevant information, enhancing decision-making processes and strategic planning. Moreover, reliable service quality fosters user satisfaction and trust, promoting consistent and effective system utilization. By adhering to the DeLone and McLean Model, this study emphasizes the integral role that quality in these dimensions plays in driving user satisfaction, system usage, and ultimately, achieving organizational goals and improved performance. Therefore, this bibliometric analysis is conducted to further understand the research domain of quality of MCS using the Delone and McLean Model throughout its history. This analysis will help to see the clusters of research domains in relation to the given keywords (Quality, MCS and Delone and McLean Model) for comprehensive view.

Method

This study utilized data obtained from the Scopus database as of June 2024. The following keywords were used to search for relevant articles related to the quality of MCS: "Delone" AND "management control system" OR "management system" OR "control system" specifically within the article titles. We focused on the titles because they effectively represent the relevant topics significant to our research area and study objectives. As noted by Chen (2010), the title of an article should include information that attracts readers' attention, being the first element, they observe. Based on our query, we obtained a total of 106 documents for bibliometric analysis referring to Figure 1.

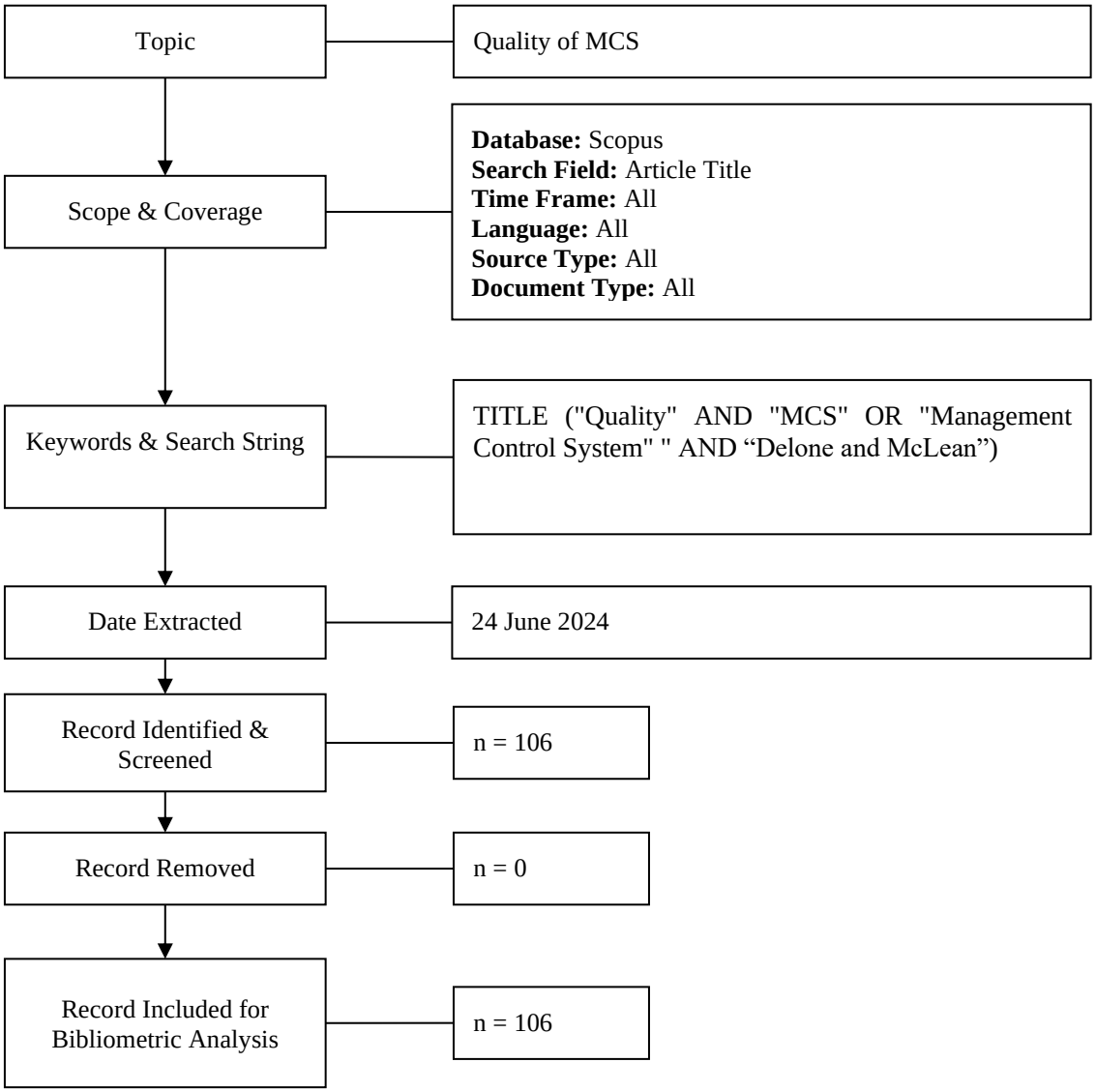

Figure 1 Flowchart of Bibliometric Analysis

Several tools are available for conducting such an analysis. For this paper, we used (1) Microsoft Excel to calculate the frequencies of published materials and to create the relevant charts and graphs; (2) VOSviewer (www.vosviewer.com) to construct and visualize bibliometric networks; and (3) Harzing’s Publish or Perish software to calculate citation metrics and other frequencies.

Bibliometric Review Findings

Utilizing data gathered from the Scopus database, we will examine various bibliometric characteristics including annual publication trends and growth rates, types of documents and sources, document languages, subject areas, keyword analysis, country contributions, authorship patterns, active institutions, and citation analysis. The majority of our findings are presented in terms of frequencies and percentages. We use VOSviewer to map the co-occurrence of author keywords, and we provide citation metrics, highlighting the top 10 most cited articles within the selected topics.

Publication by Year

The earlier articles published on quality of MCS using the Delone and McLean Model was written by Jennex & Olfman (2003) where the study was using the model to measure knowledge management success model which was followed by other scholars (Liu et al., 2005; Wu & Wang, 2006) which still focus on the context of knowledge management system. Refer to Figure 2 on overall publication by year.

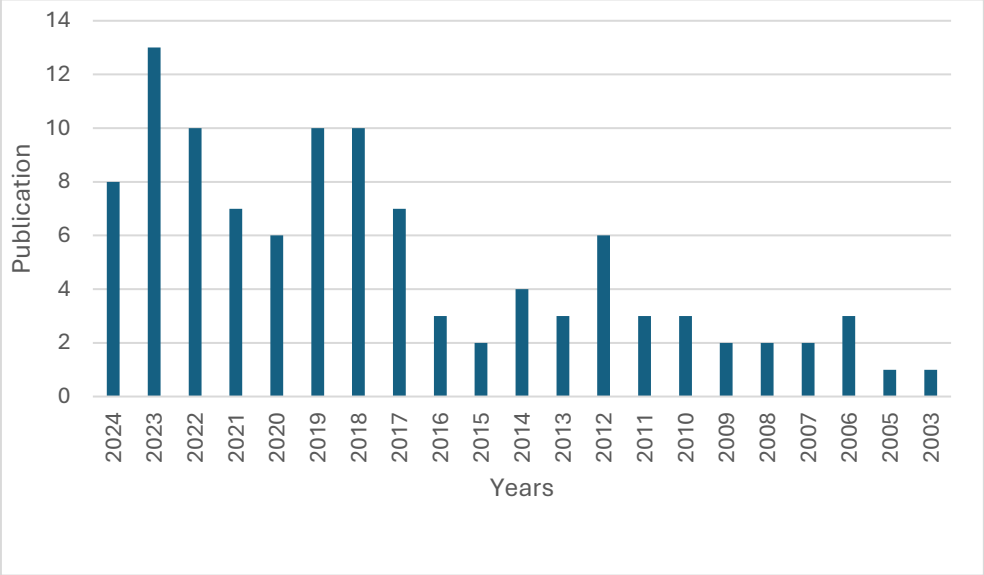

Figure 2 Number of Publication by Year

The development of publication related to the topic may not be consistent from 2003 however start to get more attention in 2017 onward which shows interest of scholars using Delone and McLean Model to underpin the quality measure of MCS. Table 1 present the total number of publications, percentage, cumulative percentage and growth percentage of document published.

Table 1 Publication by Year and Growth Rate

Year	Number of Publication (n)	Percentage (n=106)	Cumulative Percent	Growth Rate
2003	1	0.94	0.94	
2005	1	0.94	1.89	0.0
2006	3	2.83	4.72	200.0
2007	2	1.89	6.60	-33.3
2008	2	1.89	8.49	0.0
2009	2	1.89	10.38	0.0
2010	3	2.83	13.21	50.0
2011	3	2.83	16.04	0.0
2012	6	5.66	21.70	100.0
2013	3	2.83	24.53	-50.0
2014	4	3.77	28.30	33.3
2015	2	1.89	30.19	-50.0
2016	3	2.83	33.02	50.0

2017	7	6.60	39.62	133.3
2018	10	9.43	49.06	42.9
2019	10	9.43	58.49	0.0
2020	6	5.66	64.15	-40.0
2021	7	6.60	70.75	16.7
2022	10	9.43	80.19	42.9
2023	13	12.26	92.45	30.0
2024	8	7.55	100.00	-38.5
	106	**100.00**		

This inconsistencies of interest on using the Delone and Mclean Model to measure quality of MCS may stem from the existence of some other models that are commonly used to measure quality such as ADDIE Model, Total Quality Management and Sig Sigma which are looking at the process success and the Delone and McLean model is looking at the success of the system itself to deliver objectives.

Document and Source Type

We also analyze the document gathered from the Scopus database based on the document type, source type, as well as the source title. The document type can be either journal article, conference paper, review, article, book, book chapter, or editorial. Figure *3* presents the chart of the document type analyses from this study. Most publications abstracted are from journal articles, which is 65% followed by conference papers (24%). Other type of document types such as book chapters or reviews do have many publications on the topic.

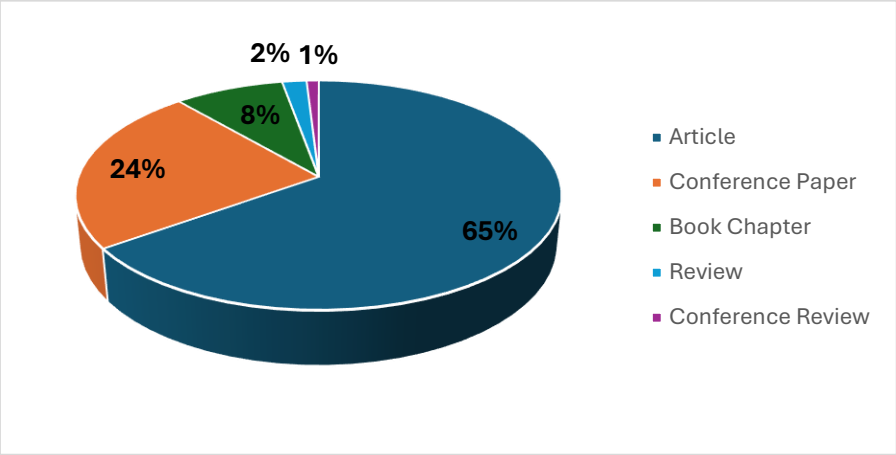

Figure 3 Document type

The data presented in Table 2 illustrates the distribution of publication types. The majority of the publications are journal articles, accounting for 71 out of 106 publications, which translates to 66.98%. This suggests that journals are the primary medium for disseminating research in this context, reflecting their importance and prevalence in academic and professional communication.

Conference proceedings constitute the second most common source type, with 23 publications making up 21.70% of the total. Books and book series are equally represented, each with 6 publications, comprising 5.66% respectively. The lower representation of books and book

series indicates that these formats are less frequently utilized for publishing research findings in this field. Overall, the data highlights a strong preference for journals and conference proceedings as the primary channels for research dissemination.

Table 2 Source Type

Source Type	Number of Publication (n)	Percentage (n=106)
Journal	71	66.98
Conference Proceeding	23	21.70
Book	6	5.66
Book Series	6	5.66
	106	**100**

Source Title

Studies on the quality of Management Control Systems (MCS) using the DeLone and McLean Model have been published across various journals, conference proceedings, and books. Table 3 highlights the top source titles where these articles have appeared. Given that there are only 106 publications on this topic, the number of articles per source title is minimal and spread across 87 different sources. Table 3 specifically lists the 13 source titles that feature more than one article, while the remaining source titles have only one article each on this topic.

Table 3 Publication by Source Title

Source Title	Number of Publication (n)	Percentage (n=106)
Education And Information Technologies	4	3.8
Journal Of Information Technology Education Research	4	3.8
Journal Of Theoretical and Applied Information Technology	4	3.8
2018 International Conference on Advanced Computer Science and Information Systems Icacsis 2018	2	1.9
Heliyon	2	1.9
Information Systems and E Business Management	2	1.9
Information Technology and Management	2	1.9
Interactive Technology and Smart Education	2	1.9
International Journal of Information and Education Technology	2	1.9
International Journal of Information Technology Project Management	2	1.9
International Journal of Knowledge Management IJKM	2	1.9
Journal of System and Management Sciences	2	1.9
Journal of Telecommunication Electronic and Computer Engineering	2	1.9

Subject Area

Further analysis reveals that the articles were published across fifteen subject areas. Table 4 highlights the top five subject areas, each comprising 8% or more of the total publications. Since the DeLone and McLean Model measures the quality of information systems, it is predominantly categorized under computer science. However, the model's application in management contexts means that the topic also appears in social sciences, business management, accounting, and decision sciences subject areas.

Table 4 Publication by Subject Area

SUBJECT AREA	Number of Publication (n)	Percentage (n=206)
Computer Science	70	33.98
Social Sciences	46	22.33
Business, Management and Accounting	29	14.08
Decision Sciences	17	8.25
Engineering	17	8.25

Keyword and Co-Occurrence Analysis

For the keyword analysis, this study employed WordSift (https://wordsift.org) to create a word cloud from the author keywords. With a cap of 100 words and a √n scale setting, the word cloud presented in Figure 4 illustrates the top 100 words (or parts of keywords) from articles on the DeLone and McLean Model and MCS. The size of each word reflects its frequency of occurrence. In addition to the keywords used for document title searches, the word cloud reveals other emerging keywords which leads to perceived usefulness, satisfaction and usage which cross path with the Unified Theory of Acceptance and Use of Technology (UTAUT) which stem from Technology Acceptance Model (TAM) (Bayastura et al., 2022; Wa Ode et al., 2024). Even though some keywords are smaller, they still signify important terms in the topic for research. All the words displayed in Figure 3 are trending in research and could be key focal points for future studies.

Figure 4 Word Cloud of the Author Keyword

Furthermore, there are three clusters of research identified based on co-occurrence analysis. The co-occurrence network of keywords related to the DeLone and McLean model in the context of Management Control Systems (MCS) illustrates several key clusters, each representing a different focus area in the research literature referring to Figure 5.

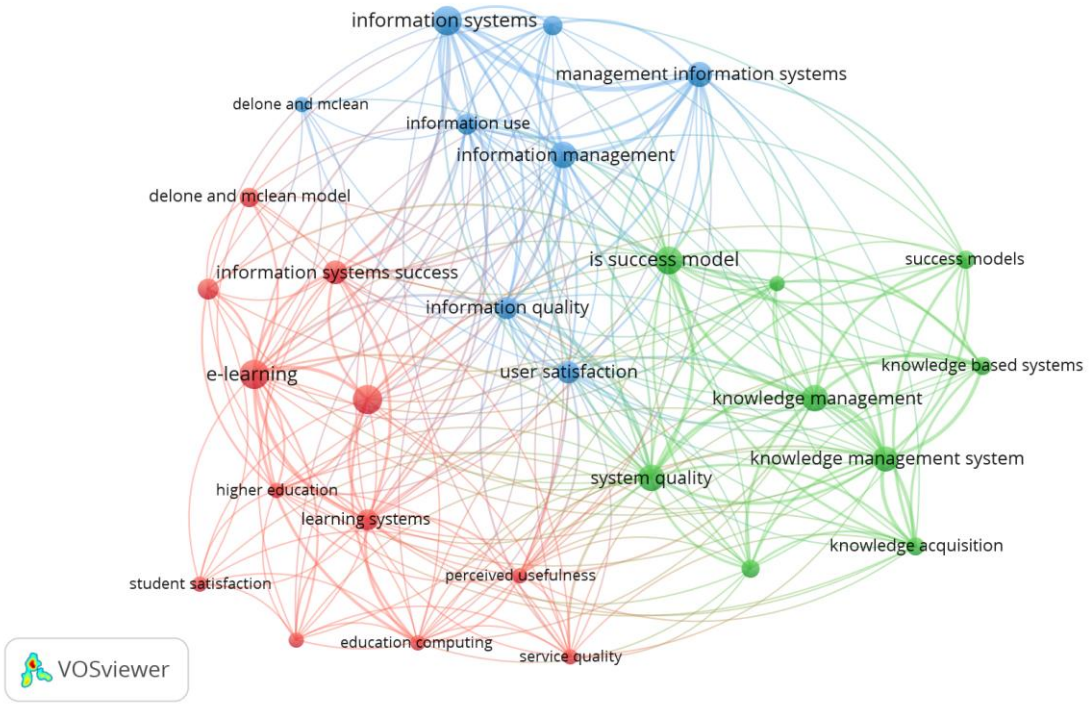

Figure 5 Keyword Co-occurrence Analysis

The first cluster on Information Systems and Management Information Systems (Blue Cluster) using keywords such as "information systems," "management information systems," "information use," and "information management" are central in this cluster. This indicates a strong emphasis on the integration and application of information systems within management control systems. The connections suggest that the DeLone and McLean model is often used to evaluate these systems' effectiveness in providing valuable information for decision-making and control.

The second cluster in red is in the context of E-learning and Education using keywords like "e-learning," "higher education," "learning systems," and "student satisfaction" highlight the application of the DeLone and McLean model in educational contexts. This cluster suggests that the model is used to assess the success of educational information systems, focusing on factors such as system quality, information quality, and user satisfaction within learning environments.

The third cluster on Knowledge Management (Green Cluster) with keywords such as "knowledge management," "knowledge-based systems," "knowledge management system," and "knowledge acquisition" form this cluster. This indicates the model's application in evaluating systems that facilitate knowledge creation, sharing, and management. The strong interconnections emphasize the role of the DeLone and McLean model in measuring the success of knowledge management initiatives and systems.

Furthermore, we can also identify a mixed cluster on information systems success and user satisfaction which is the central keywords like "information systems success," "user satisfaction," "system quality," and "service quality" span across various clusters, underlining

their fundamental importance in assessing the overall effectiveness of information systems. These keywords reflect the core components of the DeLone and McLean model, which are critical in determining how well a management control system meets its intended goals.

However, in whichever context the research was done, there is a specific applications and technologies that was adopted in the research and in Figure 5, keywords such as "delone and mclean model," "is success model," "system quality," and "information quality" suggest specific studies focusing on the theoretical aspects and practical applications of the DeLone and McLean model. This includes its use in evaluating different technological implementations and their success in achieving organizational objectives.

Overall, the co-occurrence network demonstrates that the DeLone and McLean model is widely applied across various domains, including traditional information systems, educational technologies, and knowledge management. The interconnected nature of the keywords indicates a multidisciplinary approach to assessing the success and quality of management control systems, highlighting the model's versatility and broad applicability.

Geographical Distribution of Publication

Figure 6 highlights the contributions of different countries to the body of literature on the DeLone and McLean model in Management Control Systems (MCS). Out of a total of 145 publications from 52 countries, only those countries contributing 10% are featured darker color. Malaysia leads with 13% of the publications (19 out of 145), indicating a significant focus on this research area within the country. The United States and Indonesia each contribute 10% of the publications (15 out of 145), showing a substantial interest in the application of the DeLone and McLean model in MCS within these countries. Other countries, each contribute less than 5% of the total publications, indicating that while there is broad international interest, the majority of the research is concentrated in Malaysia, the United States, and Indonesia.

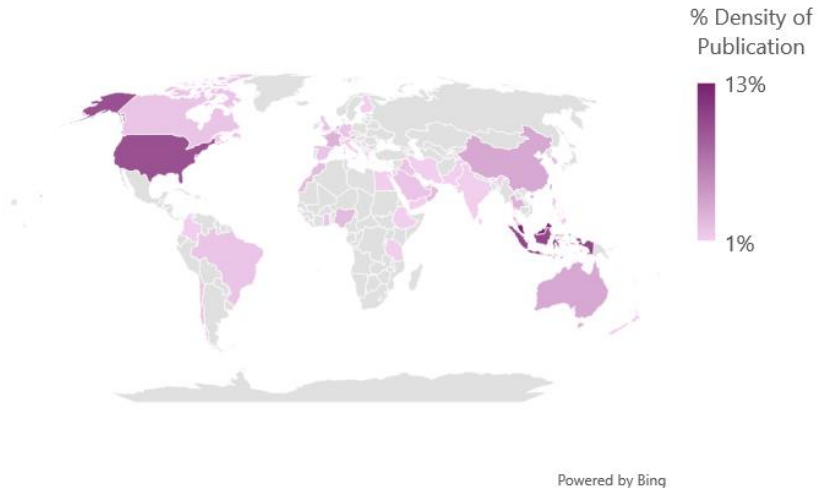

Figure 6 Countries contributed to the articles on Mclean and Delone in MCS

Authorship

In addition to that, this review also looks at number of authors per document referring to Table 5. Out of 106 publications abstracted, only 1 document which the name of author is not available. Most articles were written by between two to three authors: 35.85% and 30.19% respectively. Only 9.43% are single authored and approximately 11.32% of the documents are multi-authored of 5 or more.

Table 5 Number of Author(s) per Document

Author Count	Frequency	Percentage (n=106)
0	1	0.94
1	10	9.43
2	38	35.85
3	32	30.19
4	13	12.26
5	5	4.72
6	3	2.83
7	2	1.89
8	1	0.94
9	0	0.00
10	1	0.94
	106	**100.00**

Active Institutions

Furthermore, consistent with Figure 6, Table 6 shows institutions active in the topic of discussion came majorly from Malaysia: University Sains Malaysia and University Kebangsaan Malaysia which contributes 2.06% respectively. However, there are also other Universities from Malaysia listed from the total of 155 but not included in the table due to its contribution of less than 1.5%. From Indonesia such as Bina Nusantara University and Universitas Indonesia also contribute to total of 4.64% and The United States contributed a total of 3.61% in total from Claremont Graduate School University and San Diego State University. However, it is not limited to that there are various other institutions from other parts of the world as well that sum up the 155 institutions

Table 6 Active Institutions

AFFILIATION	Frequency	Percentage (n=194)
Bina Nusantara University	5	2.58
Universiti Sains Malaysia	4	2.06
Universiti Kebangsaan Malaysia	4	2.06
Claremont Graduate University	4	2.06
Universitas Indonesia	4	2.06
San Diego State University	3	1.55
Hassan II University of Casablanca	3	1.55
Laboratoire des Sciences et Techniques de l'Information, de la Communication et de la Connaissance Lab-Sticc	3	1.55
Ecole Normale Supérieure de l'Enseignement Technique	3	1.55

Citation Analysis

Researchers' productivity can be further analyzed by the citation of their articles. To analyzing this, Harzing's Publish and Perish will be utilizes to generate the citation per year and total citation.

Table 7 Citation Metrics

Metrics	Data
Publication years	2003 - 2024
Citation years	21
Papers	106
Citations	2400
Cites/year	114.29
Cites/paper	22.64
Authors/paper	2.94
h-index	24
g-index	48

Table 7 presents bibliometric metrics for publications on the DeLone and McLean model in Management Control Systems (MCS) from 2003 to 2024. This 21-year period reflects a concentrated focus on the topic, with significant scholarly output and impact. A total of 106 papers have been published, collectively accruing 2,400 citations, demonstrating the topic's relevance and influence within the academic community.

Analyzing the citation metrics, the average number of citations per year stands at an impressive 114.29, indicating robust and consistent engagement with the research. The average number of citations per paper is 22.64, suggesting that individual studies are well-regarded and frequently referenced. These figures highlight the substantial impact and recognition that research on the DeLone and McLean model in MCS has garnered over the years.

Authorship patterns reveal a collaborative nature of research in this field, with an average of 2.94 authors per paper. This indicates that studies often involve multiple researchers, bringing diverse perspectives and expertise to the work, which likely contributes to the high citation rates and overall quality of the publications. This finding is also consistent with Table 5.

Further bibliometric indicators such as the h-index and g-index provide additional insights into the research impact. An h-index of 24 signifies that there are 24 papers with at least 24 citations each, reflecting a solid foundation of influential research. The g-index of 48, which accounts for the distribution of citations among top papers, further underscores the presence of highly impactful studies within this body of work. Collectively, these metrics underscore the significant and lasting contribution of research on the DeLone and McLean model in MCS to the academic community.

Meanwhile, Table 8 provides an overview of the top 10 articles on the DeLone and McLean model, detailing key metrics such as authors, titles, sources, total citations (TC), and citations per year (CY).

Table 8 Top 10 Cited Articles

No	Authors	Title	Source	TC	CY
1	Wang W.-T.; Lai Y.-J.	Examining the adoption of KMS in organizations from an integrated perspective of technology, individual, and organization	Examining the adoption of KMS in organizations from an integrated perspective of technology, individual, and organization	573	31.83

2	M.E. Jennex, L. Olfman	A Model of Knowledge Management Success	International Journal of Knowledge Management (IJKM)	257	14.28
3	L.A. Halawi, R.V. McCarthy, J.E. Aronson	An empirical investigation of knowledge management systems' success	Journal of Computer Information Systems	201	11.82
4	Ramírez-Correa P.E.; Rondan-Cataluña F.J.; Arenas-Gaitán J.; Alfaro-Perez J.L.	Moderating effect of learning styles on a learning management system's success	Telematics and Informatics	79	11.29
5	Klobas J.E.; McGill T.J.	The role of involvement in learning management system success	The role of involvement in learning management system success	78	5.57
6	Kim K.; Trimi S.; Park H.; Rhee S.	The Impact of CMS Quality on the Outcomes of E-learning Systems in Higher Education: An Empirical Study	The Impact of CMS Quality on the Outcomes of E-learning Systems in Higher Education: An Empirical Study	70	5.83
7	Mtebe J.S.; Raisamo R.	A model for assessing learning management system success in higher education in sub-saharan Countries	Electronic Journal of Information Systems in Developing Countries	60	6.00
8	Wang W.-T.; Lai Y.-J.	Examining the adoption of KMS in organizations from an integrated perspective of technology, individual, and organization	Examining the adoption of KMS in organizations from an integrated perspective of technology, individual, and organization	60	6.00
9	Thongsri N.; Shen L.; Bao Y.	Investigating factors affecting learner's perception toward online learning: evidence from ClassStart application in Thailand	Behaviour and Information Technology	59	11.8
10	Alzahrani L.; Seth K.P.	Factors influencing students' satisfaction with continuous use of learning management systems during the COVID-19 pandemic: An empirical study	Education and Information Technologies	58	19.33

The most cited article by Wang & Lai (2014), that has the highest total citations at 573 and an annual citation rate of 31.83, underscoring its significant influence in the field. Another notable article is by Jennex & Olfman (2006) titled which garnered 257 citations, with an annual citation rate of 14.28, indicating its steady impact over time. Another impactful article is written by Halawi et al. (2007) also made a substantial contribution with their empirical investigation of knowledge management systems' success, which has been cited 201 times and has an annual citation rate of 11.82.

Overall, these articles highlight the significant contributions to research on knowledge and learning management systems, emphasizing various contexts and factors influencing their adoption and effectiveness. The citation metrics illustrate the ongoing relevance and impact of these studies in the academic community.

Discussion and Conclusion

This study has conducted a comprehensive review of scholarly works on the DeLone and McLean Model in the context of Management Control Systems (MCS). The study analyzes trends using selected bibliometric indicators obtained from the Scopus database. In total, 106 documents were extracted from the Scopus database, spanning the publication years 2003 to 2024. The findings indicate that research on the DeLone and McLean Model in MCS has gained significant traction over the years, with a notable increase in citations and publications.

The bibliometric data reveals several key trends. Firstly, there has been a steady rise in the number of publications since 2003, with the highest number of citations occurring in recent years, reflecting growing interest and relevance in this field. Most publications are collaborative, with an average of 2.94 authors per paper, highlighting a trend towards greater collaboration among researchers. The h-index of 24 and g-index of 48 underscore the impactful nature of these works, indicating that many articles have been widely cited and influential.

Geographically, Malaysia leads with 13% of the total publications, followed by the United States and Indonesia, each contributing 10%. This distribution showcases the international scope of research on the DeLone and McLean Model, with substantial contributions from Asian countries alongside notable input from Western nations. This global interest underscores the model's applicability across different cultural and organizational contexts.

The co-occurrence network of keywords reveals that the primary focus areas include information systems, management information systems, e-learning, and knowledge management. These clusters indicate a broad application of the model, extending beyond traditional information systems evaluation to educational technologies and knowledge management, among other domains. This interconnectedness suggests a rich field of study where various aspects of system quality, user satisfaction, and information quality are critical components.

Despite the valuable insights provided by this study, several limitations should be acknowledged. The reliance on specific queries and keywords to extract data from the Scopus database means some relevant works might have been overlooked. Additionally, while Scopus is a comprehensive database, it does not capture all scholarly works, leading to potential exclusions. These factors may result in false positives and negatives, though they are common challenges in bibliometric studies.

In conclusion, this study offers a detailed overview of the current trends in research on the DeLone and McLean Model in MCS. The increasing number of publications and citations, alongside the diverse geographic contributions, demonstrate the model's widespread relevance and applicability. Future research should continue to explore emerging areas such as digital transformation and blockchain technology, ensuring the DeLone and McLean Model remains a pivotal tool in evaluating information system success. Despite its limitations, this study provides a valuable snapshot of the global research landscape, highlighting key trends and areas for future exploration.

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