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Editor-in-chief:
Justyna Fijałkowska

Text design and typesetting:
Agnieszka Terczyńska, Studio Grafpa www.grafpa.pl

Cover design:
Agnieszka Terczyńska, Studio Grafpa www.grafpa.pl

Language editing:
Agnieszka Zerka-Rosik

Adjustment:
Julia Żak

Editorial office:
Społeczna Akademia Nauk, Sienkiewicza 9, 90-113 Łódź
e-mail: wydawnictwo@san.edu.pl

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Contents

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Journal of Intercultural Management
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Justyna Fijałkowska
SAN University, Poland
University of Lodz, Poland
Turin University, Italy
jfijalkowska@san.edu.pl

Małgorzata Domańska
SAN University, Poland
mdomanska@san.edu.pl

Culture, Management Accounting Practices, and Managerial Decision--Making: A Bibliometric Analysis of the Organizational-National Divide

Abstract

Objective: This study maps the intellectual structure and thematic evolution of the scholarly literature at the intersection of national and organizational culture, management accounting practices, and managerial decision-making, in order to identify the field's dominant themes, establish whether cultural analysis in this literature operates predominantly at the national or organizational level, and surface the specific research gaps that remain.

Methodology: A systematic bibliometric review was conducted following the PRISMA protocol. A Scopus search combining culture-related and management accounting/decision-making terms returned 1,587 records. A two-stage screening process, applying explicit inclusion and exclusion criteria, yielded a final corpus of 483 records. Performance analysis and science mapping were carried out using Biblioshiny (Bibliometrix), complemented by a systematic text-mining scan of abstract content to surface author-stated research gaps across the corpus.

Findings: The field is in a rapid growth phase, with publication volume nearly tripling since 2022. Research output is geographically diverse, led by the United States but increasingly driven by China, Indonesia, and Malaysia. Three independent bibliometric analyses: trend topic evolution, co-occurrence network mapping, and thematic mapping – converge on the same structural conclusion. Research on organizational culture represents the field's dominant "Basic Theme". Conversely, Hofstede-anchored cross-cultural research at the national level occupies a peripheral, low-density position, classifying it among "Emerging or Declining Themes". A complementary text-mining analysis of the corpus's abstracts corroborates this pattern from within the primary studies themselves: calls for genuinely comparative, multi-country research designs are among the most frequently self-reported gaps in the literature – matched in prevalence only by calls for research on the culturally embedded adoption of artificial intelligence in management accounting, a separate but equally prominent emerging concern.

Value Added: To the authors' knowledge, this study provides the first bibliometric mapping of the intersection between management accounting practices and managerial decision-making. It offers empirical, data-driven evidence – moving beyond purely narrative impressions – that cross-national comparative research remains significantly underdeveloped compared to firm-level organizational culture studies within this literature, and it surfaces the specific thematic and methodological gaps that future research should prioritize.

Recommendations: Future empirical work should prioritize explicit cross-national comparative designs grounded in established cultural-dimensions frameworks (e.g., Hofstede, Gray) to strengthen the intercultural dimension of this research area, rather than continuing to rely on organizational culture as a proxy for national-level cultural variation. Particular attention should be paid to underrepresented sectors and regions (SMEs, the public sector, emerging markets), to the culturally embedded adoption of artificial intelligence, and to longitudinal, mixed-methods designs – the specific gaps most frequently self-reported by the primary literature.

Keywords: national culture, organizational culture, management accounting, managerial decision-making, bibliometric analysis, PRISMA, Hofstede

JEL codes: M41, M14, D91

Introduction

Management accounting has traditionally been treated as a technical discipline governed by universal principles of cost measurement, budgeting, and performance evaluation, applicable regardless of organizational or national context. Over the past four decades, however, a substantial body of research has challenged this assumption, showing that the design and use of management accounting systems, and the decision-making processes they support, are

systematically shaped by the cultural values of the societies and organizations in which they operate.

Despite the theoretical maturity of this research theme – rooted most notably in Hofstede's cultural dimensions (Hofstede, 1980) and Gray's accounting values (Gray, 1988) – the literature itself has not, to the authors' knowledge, been systematically mapped using bibliometric methods. It remains unknown, in any data-driven sense, whether four decades of accumulated research have actually delivered on the field's founding premise – that management accounting and decision-making practices vary systematically with *national* culture – or whether the empirical record has, in practice, drifted toward a narrower, firm-level conception of culture that is easier to study but theoretically less ambitious.

The objective of this study is therefore threefold. First, it aims to map the intellectual structure, growth trajectory, citation impact, and geographic distribution of the scholarly literature at the intersection of culture, management accounting practices, and managerial decision-making, using a systematic, PRISMA-guided bibliometric methodology applied to a Scopus-derived corpus (n = 483). Second, and more specifically, it aims to establish – using three independent, mutually corroborating bibliometric lenses (trend-topic evolution, co-occurrence network mapping, and thematic mapping) – whether the field's engagement with "culture" is genuinely intercultural in nature, operating at the national/cross-country level consistent with its Hofstede- and Gray-based theoretical foundations, or whether it is predominantly organizational in scope. Third, it aims to complement this structural, network-based evidence with a systematic text-mining scan of the limitations and future research avenues stated within the abstracts of the primary studies. By doing so, this investigation surfaces the most pressing, author-identified research gaps in the field and assesses the extent to which they corroborate the quantitative findings.

In addressing this objective, the study offers what is, to the authors' knowledge, the first bibliometric mapping of this specific intersection of literatures – providing empirical, data-driven evidence, rather than a narrative impression, of the extent to which genuinely cross-national comparative research has kept pace with the field's dominant organizational-culture research stream.

The remainder of the article proceeds as follows. Section *Methodology* details the methodology, including the search protocol, screening procedure, and analytical approach. Section *Results* presents the results of the bibliometric analysis. Section *Synthesis and discussion* synthesizes these findings to establish the field's structural orientation toward organizational versus national culture, and presents a systematic taxonomy of the research gaps identified across the primary literature. Section *Limitations and future research* discusses the study's limitations and outlines directions for future research.

Methodology

Research approach

Given the breadth and cross-disciplinary nature of literature linking national culture to management accounting practices and managerial decision-making, this study adopts a systematic literature review approach. Methodologically, a systematic review is uniquely suited for this domain, as it minimizes the subjectivity and selection bias often inherent in narrative reviews. By employing rigorous, pre-defined protocols, this approach ensures transparency, reproducibility, and a comprehensive mapping of the existing academic landscape (Tranfield et al., 2003). To ensure structural integrity and methodological rigor, the execution of this review strictly adheres to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (Moher et al., 2009). The PRISMA flow diagram serves as the operational blueprint, systematically guiding the research through four distinct phases: identification, screening, eligibility, and inclusion. By utilizing this structured framework, the gathered literature can be rigorously analyzed through a dual-lens approach:

- Quantitative Analysis: Utilizing bibliometric indicators to map e.g., publication trends, influential journals, and citation impact.
- Qualitative Analysis: Applying a systematic text-mining scan of abstract content to surface author-stated research gaps and calls for future

research, complementing the structural bibliometric evidence with a second, independent line of evidence grounded in the primary studies' own conclusions.

This dual-lens architecture is applied specifically to test whether the field's engagement with culture operates predominantly at the national or organizational level (section *Structural evidence from bibliometric mapping*), and to surface the research gaps that remain (section *Research gaps identified in the literature*).

Data source and search protocol

The bibliographic dataset was retrieved from Scopus on 18 April 2026. Scopus was selected for its broad multidisciplinary coverage and its established use in bibliometric and systematic reviews in accounting, management, and cross-cultural research (Okoli, 2015; Donthu et al., 2021). The search was conducted in the TITLE-ABS-KEY field and combined two conceptual blocks: a culture-related block and a management accounting/managerial decision-making block, joined by the Boolean operator AND.

The first block captured terms denoting national and organizational culture: "national culture", "organisational culture", "cross-cultural", "cross cultural", "cultural dimension*", "cultural value*", hofstede, and "cultural difference*". The second block captured terms denoting management accounting practices and managerial decision-making: "management accounting", "managerial accounting", "cost accounting", "cost control", "management control system*", budgeting, "budgetary participation", "managerial decision*", "decision-making", and "decision making".

TITLE-ABS-KEY (("national culture" OR "organi?ational culture" OR "cross-cultural" OR "cross cultural"
OR "cultural dimension*" OR "cultural value*" OR hofstede OR "cultural difference*")
AND ("management accounting" OR "managerial accounting" OR "cost accounting" OR "cost control"

OR “management control system*” OR budgeting OR “budgetary participation”
OR “managerial decision*”
OR “decision-making” OR “decision making”))
AND SUBJAREA (BUSI OR ECON OR DECI)
AND DOCTYPE (ar OR re)
AND LANGUAGE (english)
AND PUBYEAR > 2006

The search was restricted to peer-reviewed journal articles and reviews (DOCTYPE: ar, re), published in English, within the Business, Management and Accounting; Economics, Econometrics and Finance; and Decision Sciences subject areas (SUBJAREA: BUSI, ECON, DECI), and limited to publications from 2006 onward, in order to capture two decades of research activity following the consolidation of Hofstede- and Gray-based cross-cultural accounting frameworks in the literature.

Corpus construction and screening

The initial search returned 1,587 records. Data quality assessment found no duplicate titles, no duplicate DOIs among records with a non-missing DOI, and no missing abstracts, so no records were removed at the deduplication stage. The corpus comprised 1,507 articles and 80 reviews, spanning publication years 2006–2026, with a marked concentration in the most recent period: 517 records (32.6%) were published between 2024 and 2026, indicating sustained and growing research activity in this field.

Records were then screened against the following inclusion and exclusion criteria.

Inclusion criteria:

- Peer-reviewed journal articles and reviews
- Published in English, 2006 onward
- Indexed under Business, Management and Accounting; Economics, Econometrics and Finance; or Decision Sciences

- Directly addressing the intersection of national/organizational culture and management accounting practices, cost control, budgeting, management control systems, or managerial decision-making

Exclusion criteria:

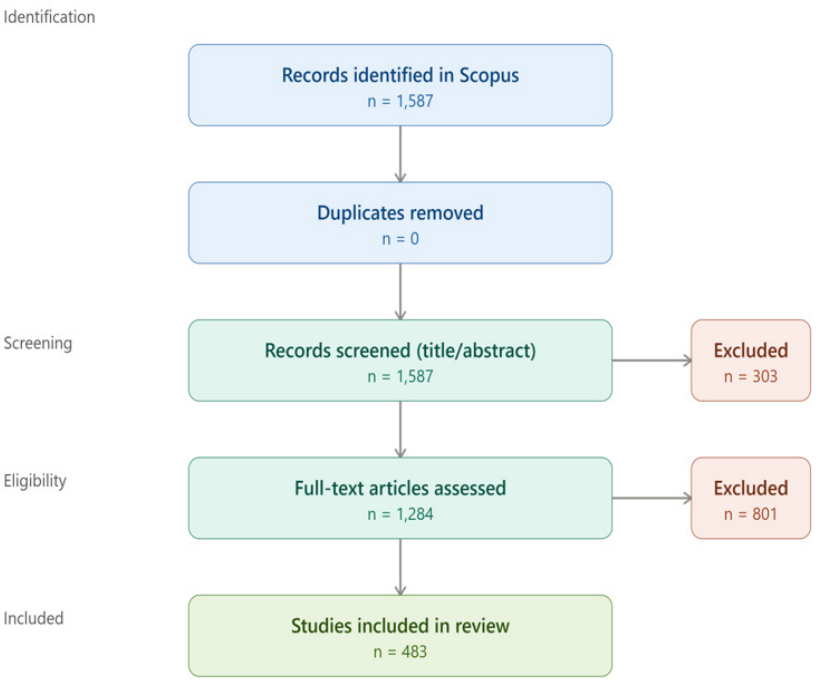
- Records addressing culture or accounting/decision-making separately, without an explicit link between the two constructs
- Records focusing exclusively on financial (rather than management) accounting, unless culture was a central variable
- Records for which the abstract, on closer reading, indicated no substantive engagement with either construct

At the title/abstract screening stage, 303 records were excluded: 172 for lacking any organizational or managerial anchor (matching the search string only through the generic "decision-making" term, with no reference to managers, firms, organizations, or employees) and 131 for falling outside the managerial domain despite the keyword match (e.g., clinical, tourism, or consumer-purchasing contexts). The remaining 1,284 records proceeded to full-text eligibility assessment.

At the full-text stage, a further 801 records were excluded for lacking a substantive link to a management accounting or control practice (cost, budgeting, control systems, performance measurement, resource allocation, financial reporting, or audit), despite an organizational or managerial framing.

The final corpus comprised 483 records, which formed the basis for the bibliometric analysis (section *Results*) and thematic synthesis (section *Synthesis and discussion*). The complete multi-stage selection process, including specific reasons for exclusion at each phase, is visually summarized in Figure 1.

Figure 1. PRISMA flow diagram of the study selection process



Source: Own elaboration based on the search and screening protocol described in section *Corpus construction and screening* (Scopus search, n = 1,587; final corpus, n = 483).

Analytical approach

The final corpus was analyzed using Biblioshiny (an R-based interface to the Bibliometrix package; Aria & Cuccurullo, 2017) to generate performance indicators (annual scientific production, most relevant sources and authors, citation impact) and science mapping outputs (keyword co-occurrence, thematic maps, thematic evolution, and trend topics), addressing the study's first and second objectives. To address the third objective – surfacing the field's author-stated research gaps – a systematic text-mining scan was subsequently applied to the abstract of every record in the final corpus (n = 483), searching for explicit

gap-signaling language (e.g., “future research”, “lack of”, “remains unclear”, “underexplored”). Matching sentences were extracted and thematically grouped to identify recurring categories of self-reported limitation across the literature, providing an independent, author-stated line of evidence to complement the structural bibliometric findings.

Results

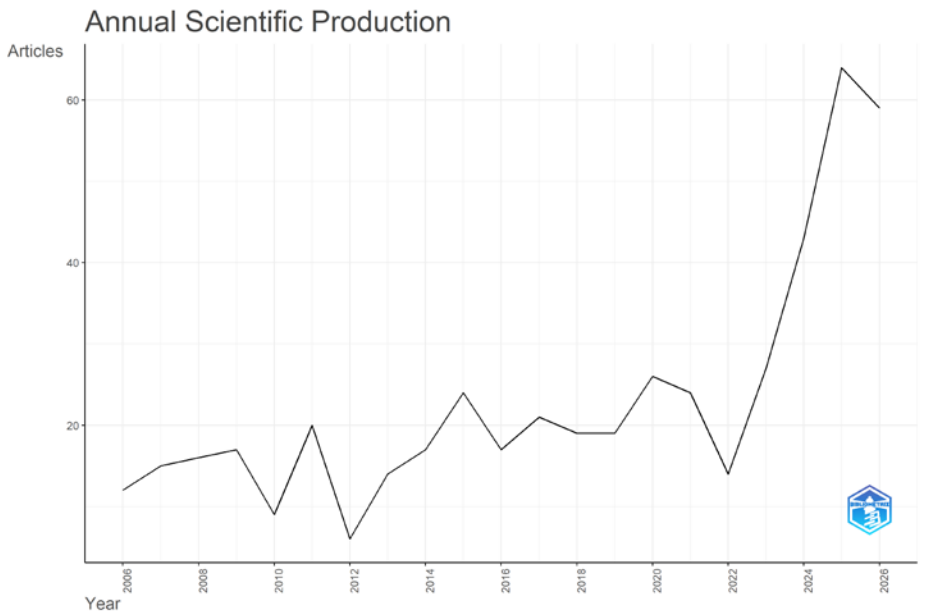
Data completeness

A missing-data assessment of the final corpus confirmed high level of completeness across all core bibliometric fields. Specifically, the abstract, document type, source title, publication year, title, and citation count fields were fully populated (0% missing). Minor gaps were observed for author (0.62%), affiliation (1.86%), DOI (3.52%), and author keywords (4.97%), consistent with normal levels of metadata completeness in Scopus exports.

Annual scientific production

Figure 2 presents the annual distribution of publications in the final corpus (n = 483) across the 2006–2026 period.

Figure 2. Annual scientific production, 2006–2026



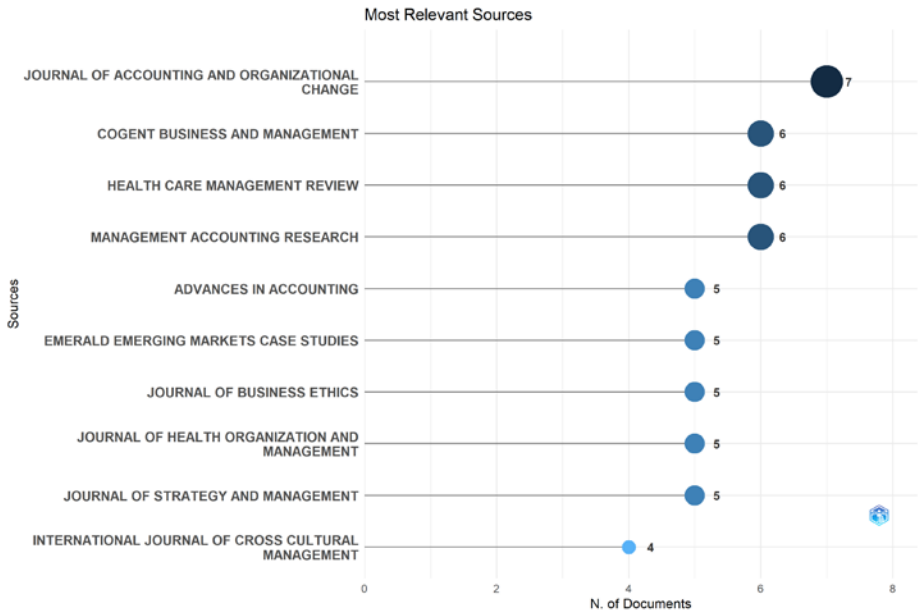
Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny (Bibliometrix R package; Aria & Cuccurullo, 2017).

The data reveals two distinct phases in the academic discourse: a prolonged period of stable but modest research output between 2006 and 2022 (averaging fewer than 20 publications annually), followed by a sharp, exponential expansion beginning in 2023. Academic production reached its highest volume in 2025, with over 60 published documents. The exceptionally high volume of publications in the final years (2024–2026) underscores a rapidly intensifying academic interest and a growing consensus regarding the strategic importance of this research domain. The apparent decline to 59 articles in 2026 should not be read as a genuine downturn: since the Scopus search was executed in July 2026, the 2026 count reflects only a partial year of indexing and will continue to rise as further 2026 publications are indexed. Excluding this truncated final year, the corpus shows a clear and accelerating growth trend from 2022 onward.

Most relevant sources

Figure 3 illustrates the top ten most productive and relevant publication outlets within the final corpus, ranked by the number of indexed documents. The distribution reveals a highly diversified and interdisciplinary publishing landscape, spanning accounting, general management, ethics, and sector-specific fields.

Figure 3. Most relevant sources



Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

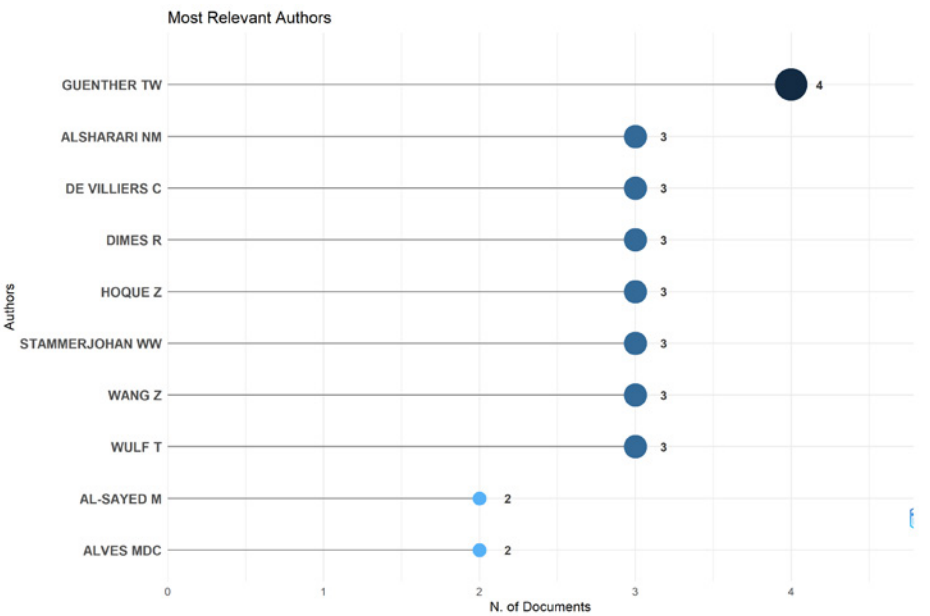
Journal of Accounting and Organizational Change leads with 7 publications, followed by a cluster of three journals tied at 6 documents each: Cogent Business and Management, Health Care Management Review, and Management Accounting Research – one of the field's most prestigious specialist outlets. A further six journals contribute 4–5 documents each, including Advances in Accounting, Journal of Business Ethics, Journal of Strategy and Management, and International Journal of Cross Cultural Management. No single source dominates the field – the top journal accounts for only 1.4% of the corpus. This heterogeneous

distribution emphasizes that the intersection of national culture, management control systems, and managerial decision-making is not confined to isolated accounting circles, but is heavily embedded in broader organizational, ethical, and cross-cultural management discourse.

Most relevant authors

Figure 4 illustrates the top ten most productive authors within the final corpus, ranked by their total number of indexed documents. The data reveals a highly fragmented authorship landscape, characterized by a low concentration of publications per individual scholar.

Figure 4. Most relevant authors



Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

From a bibliometric standpoint, this narrow production differential and the low maximum threshold (four articles) suggest that the research domain linking national culture to management accounting and decision-making is characterized

by wide academic participation rather than domination by a select few foundational authors. This pattern is typical for multidisciplinary fields where diverse research teams independently investigate cross-cultural variations across different institutional settings.

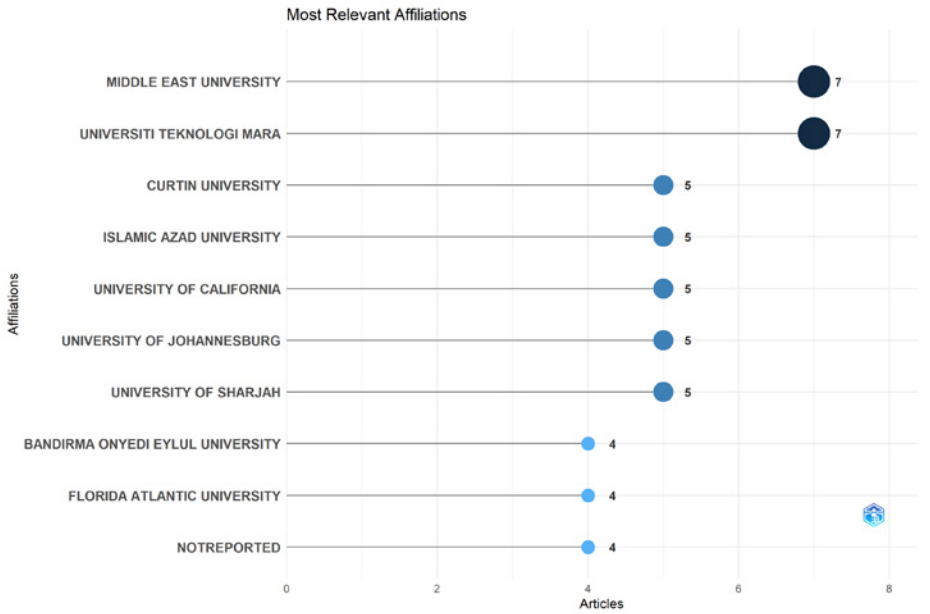
Examining the thematic focus of these authors' contributions reveals that their prolificacy is not incidental but reflects sustained research programs within specific corners of the field. Guenther's four papers center on management control systems and their interaction with organizational culture, spanning family businesses (Einhorn et al., 2021), environmental management control (Nishitani et al., 2026; Einhorn et al., 2024), and the conceptual foundations of German-speaking "controlling" traditions relative to Anglo-American frameworks (Guenther, 2013). Alsharari's work applies institutional and contingency perspectives to management accounting change in public-sector and Middle Eastern contexts (Alsharari & Daniels, 2024; Alsharari & Aljohani, 2024; Alsharari, 2017). De Villiers and Dimes form a tightly integrated research pair examining how management control systems enable or constrain integrated thinking and integrated reporting (Dimes & de Villiers, 2020, 2024; Bezuidenhout et al., 2023). Hoque's contributions trace organizational and accounting change processes, including activity-based costing implementation and cost management as organizational change (Zhang et al., 2015; Bell et al., 2009; Bell et al., 2009). Stammerjohan's program concentrates specifically on budgetary participation across national cultures, particularly comparing Mexican and U.S. managers (Stammerjohan et al., 2015; Leach-López et al., 2008; Leach-López et al., 2008). Wang's work bridges cultural time orientation and participative budgeting (Wang & Hunton, 2011) with a recent cross-cultural replication of the levers-of-control framework (Wang et al., 2025). Wulf's papers, together with long-standing co-authors Florian and Meissner, form a coherent stream on how executives from different national cultures interpret strategic issues, incorporating emotional and framing effects (Wulf et al., 2020; Neumann & Wulf, 2022; Florian et al., 2024). Notably, the Wulf–Florian–Meissner and De Villiers–Dimes clusters are the only two author groups in the corpus whose output constitutes genuine sustained cross-national comparative or management-control-systems research programs, reinforcing the structural finding of section *Structural evidence from bibliometric mapping*

that such focused programs remain the exception rather than the rule in this literature.

Most relevant affiliations

Figure 5 shows the ten most productive institutional affiliations based on the number of articles contributed to the final corpus. The institutional distribution highlights a highly globalized and geographically diverse research interest, with strong representation from emerging markets, the Middle East, and Western economies.

Figure 5. Most relevant affiliations



Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

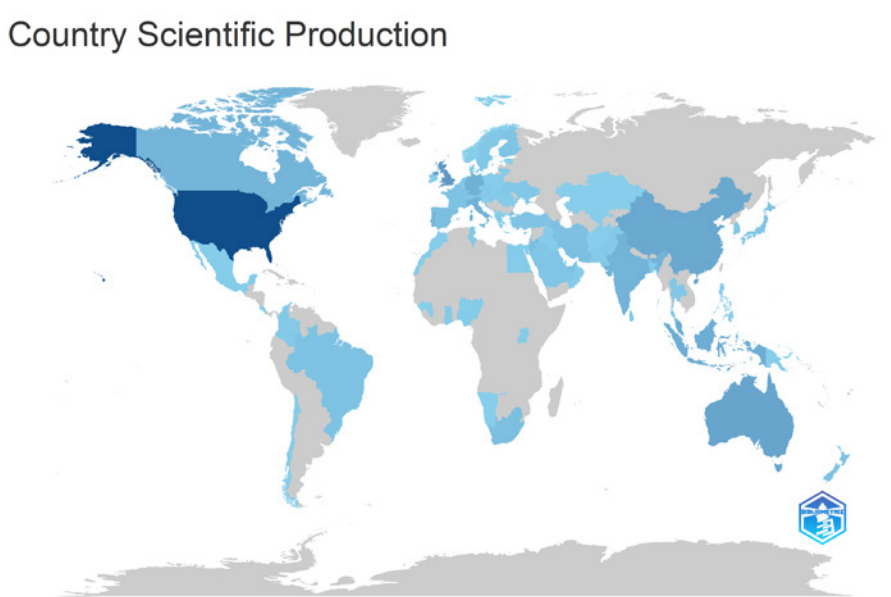
Middle East University and Universiti Teknologi MARA lead jointly with 7 documents each, followed by a group of five institutions tied at 5 documents: Curtin University, Islamic Azad University, University of California, University of Johannesburg, and University of Sharjah. The geographic spread of leading

affiliations – spanning the Middle East, Southeast Asia, Africa, Iran, Australia, and the United States – indicates that research is being produced across a wide and genuinely international set of institutions. This institutional profile underscores that the exploration of national culture within management control systems and managerial accounting is truly global, drawing significant empirical and theoretical contributions from diverse cultural frameworks worldwide.

Countries' scientific production

Figure 6 provides a macroeconomic mapping of global research productivity, capturing the geographic distribution of the literature linking national culture to management accounting and decision-making frameworks. The density of publication output is reflected in the color intensity, running from light blue (low production) to dark blue (high production).

Figure 6. Countries' scientific production



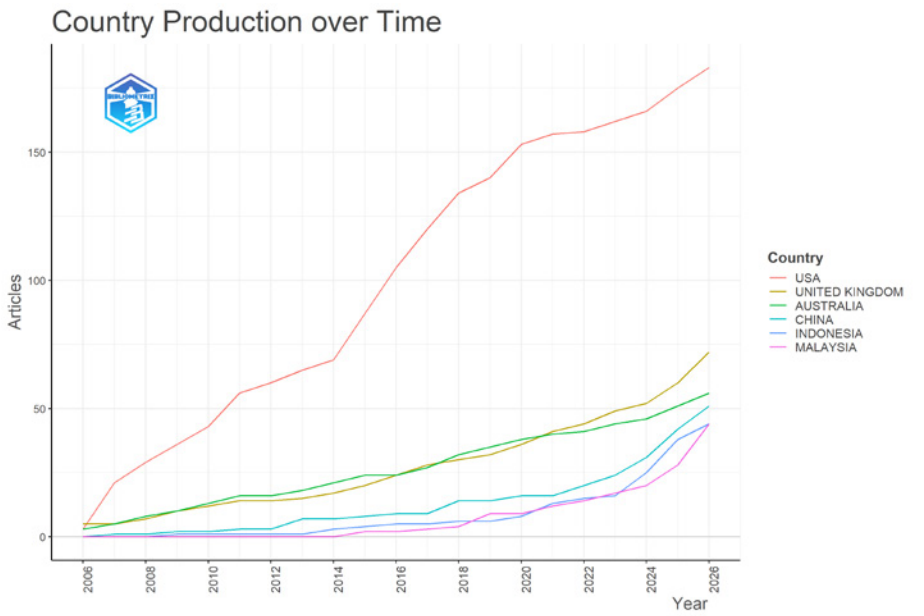
Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

The visual evidence underscores a clear concentration of academic output in North America, with the United States emerging as the primary global hub for research in this domain. Beyond North America, the field displays a strong, widespread dispersion across several macro-regions. In Europe, substantial contributions are visible across both Western and Central-Eastern European countries, reflecting a sustained institutional commitment to cross-cultural accounting research. Significant research activity is also highly visible across the Asia-Pacific region – particularly in China, India, Australia, and Malaysia – as well as the Middle East and parts of South America (such as Brazil) and Africa (South Africa). This global footprint is highly aligned with the core tenets of cross-cultural management studies; the widespread geographic distribution indicates that institutional environments and local cultural dimensions continue to serve as highly relevant empirical contexts for evaluating contemporary management control systems globally.

Country production over time

Figure 7 tracks cumulative production for the six most productive countries between 2006 and 2026.

Figure 7. Country production over time



Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

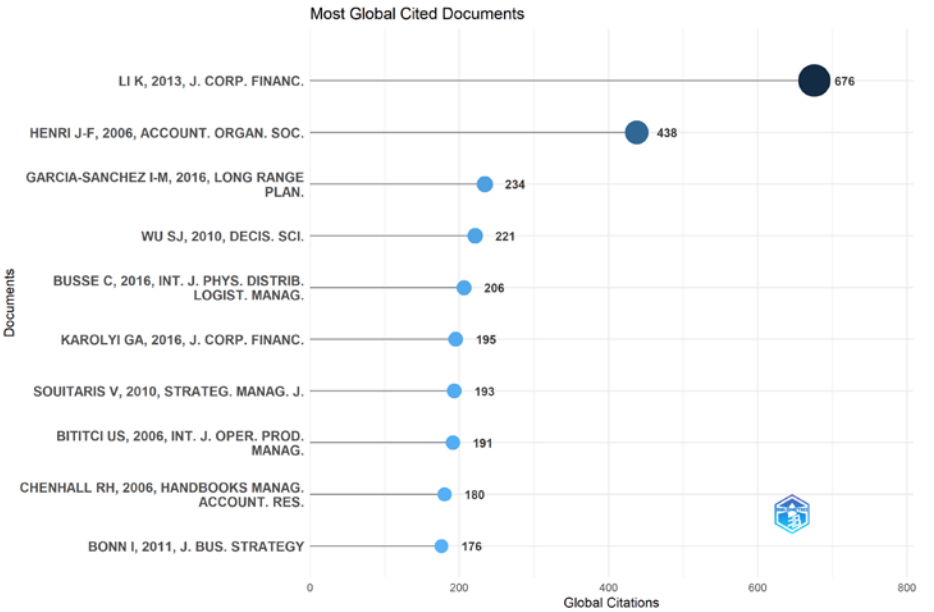
The United States has led throughout, reaching approximately 180 cumulative articles by 2026 – nearly triple the level of the second-ranked country. The United Kingdom and Australia tracked each other closely until around 2020, after which the United Kingdom pulled ahead. China shows negligible output before 2014 followed by steady, accelerating growth. Indonesia and Malaysia are the most recent entrants, with essentially zero output before 2018–2019 but the steepest recent growth rates in the figure, both surpassing 40 cumulative articles by 2026. This shift toward broader, more geographically distributed contribution suggests the literature is diversifying in its country of origin at the same time as it is expanding in volume.

Most globally cited documents

Figure 8 presents the top ten most globally cited documents within the analyzed corpus, capturing the intellectual foundational works that shape the discourse

on national culture, management control systems, and decision-making. The citation metrics reveal a clear hierarchical structure, anchored by two landmark studies that substantially outpace the rest of the corpus in terms of total citations.

Figure 8. Most globally cited documents



Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

The most influential study in the dataset is Li K. (2013, *Journal of Corporate Finance*), securing a dominant position with 676 global citations. This is followed by Henri J-F. (2006, *Accounting, Organizations and Society*) with 438 citations, representing a seminal theoretical and empirical reference point for management control research. The remaining eight papers cluster in the 176–234 citation range. This group includes key contributions by Garcia-Sanchez I-M. (2016, *Long Range Planning*, 234 citations), Wu SJ (2010, *Decision Sciences*, 221 citations), Busse C. (2016, *International Journal of Physical Distribution & Logistics Management*, 206 citations), and Karolyi GA (2016, *Journal of Corporate Finance*, 195 citations). The ranking is completed by impactful articles focusing on strategic management, operations, and organizational control by Souitaris V. (2010,

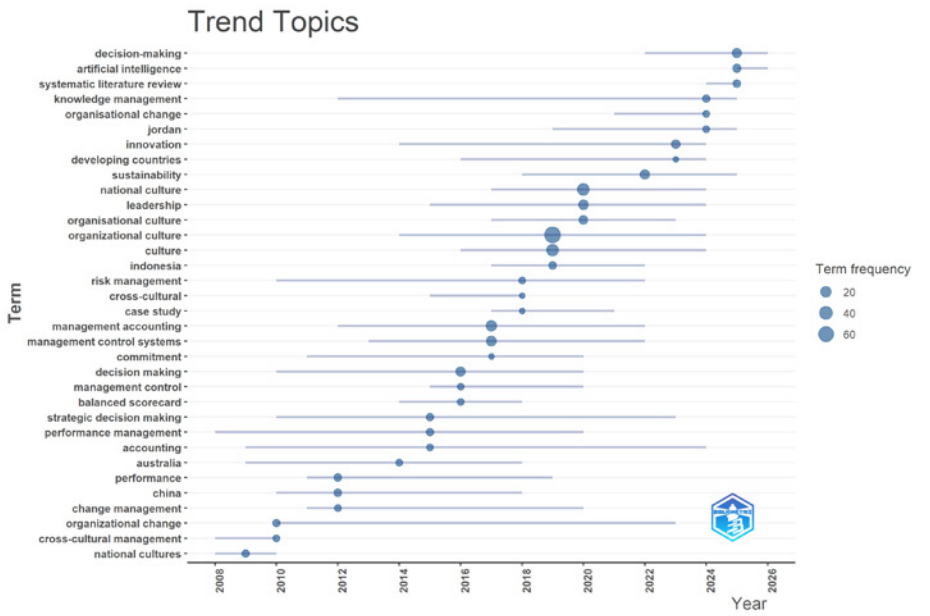
193 citations), Bititci US (2006, 191 citations), Chenhall RH (2006, *Handbooks of Management Accounting Research*, 180 citations), and Bonn I. (2011, 176 citations).

Only two entries – Henri (2006) and Chenhall (2006) – are core management accounting/control works in the strict sense; the remainder come from corporate finance, strategy, operations management, and logistics, reflecting the corpus's broad, interdisciplinary composition. Notably, six of the ten most-cited papers were published in 2006, 2010, or 2011, indicating that citation impact in this literature accrues over a long horizon and that the recent surge in publication volume (2023–2026) has not yet had time to produce comparably highly cited work.

Trend topics

Figure 10 provides a temporal mapping of keyword trajectories from 2008 to 2026, capturing the dynamic evolution and conceptual shifts within the research field. The horizontal lines denote the timeframe during which specific terms appeared, while the size and position of the nodes represent term – frequency and median publication year, respectively.

Figure 9. Trend topics



Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

An early wave (2008–2013) centers on macro-level constructs ("national cultures", "cross-cultural management"). In this phase, the early literature focused predominantly on fundamental management concepts, including *change management*, *organizational change*, and broad geographic contexts such as *China* and *Australia*. A middle wave (2014–2018) shifts toward accounting-specific practice terms ("management accounting", "management control systems", "balanced scorecard"). The most recent and largest wave (2019–2020) is dominated by "organizational culture" and "culture", both peaking around 2019 showing that the field's center of gravity moved decisively toward organizational-level culture research around 2019–2020. The most recent period (2022–2026) demonstrates a clear paradigm shift toward contemporary technological, methodological, and institutional drivers. Emerging topics with peak activity between 2024 and 2026 are heavily dominated by "artificial intelligence", "knowledge management", "sustainability", "organisational change", and "systematic literature review" as the newest, still-narrow trend terms.

This longitudinal progression highlights a maturation of the field – transitioning from basic cross-cultural comparisons toward complex integrations of digital technology (AI), sustainable governance, and rigorous synthesis methodologies.

Co-occurrence network

Figure 10 presents the keyword co-occurrence network, illustrating the relational architecture and conceptual sub-domains within the analyzed literature.

Figure 10. Co-occurrence network

Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

The node size corresponds to keyword frequency, edge thickness reflects the strength of co-occurrence, and distinct colors designate thematic clusters identified through network community detection.

The network reveals a highly interconnected structure anchored around two main hubs – "organizational culture" and "management accounting" – and is differentiated into several distinct clusters:

- **Red Cluster (Management Accounting & Governance):** this cluster bridges core functional accounting tools with decision-making frameworks. Key nodes include *management accounting*, *balanced scorecard*, *decision making*, and *governance*, highlighting how accounting control mechanisms support strategic choices within structured governance settings.

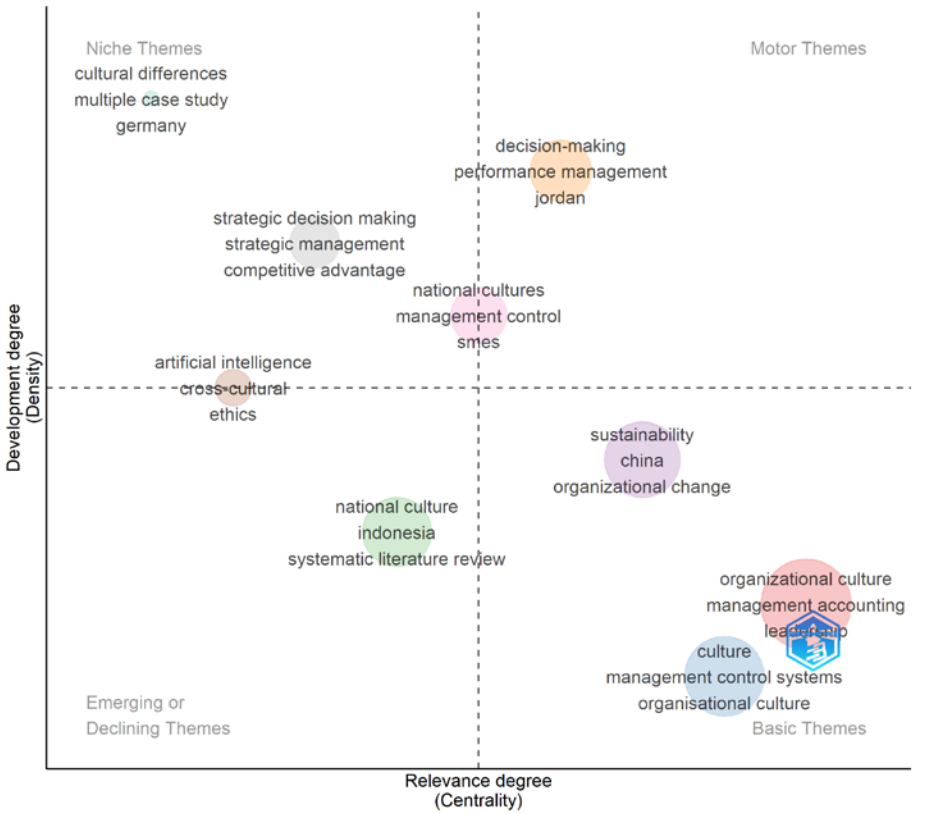
- **Green Cluster (National Culture & Cross-Cultural Foundations):** this group represents the macro-cultural foundation of the field. Anchored by *national culture*, *leadership*, *Hofstede*, and *management control*, alongside empirical contexts such as *Indonesia* and *Australia*, this cluster captures cross-cultural comparisons and foundational cultural dimensions applied to organizational control.
- **Blue Cluster (Performance & Systems Control):** this cluster connects general *culture* with operational outcomes. Key terms include *management control systems*, *performance*, *commitment*, *innovation*, *artificial intelligence*, and *strategic decision making*, capturing how control systems drive performance and innovation.
- **Purple Cluster (Contemporary Drivers & Ethics):** this cluster focuses on emerging societal and technological dynamics, comprising *sustainability*, *ethics*, *change management*, *digital transformation*, and *developing countries*.
- **Brown Cluster (Organizational Change & Adaptation):** this cluster emphasizes internal dynamics, grouping *organisational culture*, *organisational change*, and country-level contexts such as *China*.

The central positioning and thick connecting edges between *organizational culture*, *management accounting*, and *national culture* confirm that the literature successfully integrates macro-level cultural models with micro-level organizational accounting practices.

Thematic map

Figure 11 presents the thematic map of the research field, structured across a two-dimensional strategic matrix based on Callon's centrality (relevance degree, x-axis) and density (development degree, y-axis).

Figure 11. Thematic map



Source: Own elaboration based on Scopus data (n = 483), generated using Biblioshiny.

The positioning of clusters across the four quadrants provides a strategic overview of the conceptual maturity and structural importance of topics within the corpus:

– **Motor Themes (Upper-Right Quadrant):** Characterized by high centrality and high density, these represent the driving forces of the field. This quadrant features topics such as *decision-making*, *performance management*, and specific national settings like *Jordan*, indicating well--developed, highly relevant streams of empirical inquiry. Positioned near

the boundary are broader organizational control themes (*national cultures*, *management control*, *smes*).

- **Basic Themes (Lower-Right Quadrant):** Exhibiting high centrality but lower density, these constitute the transversal, foundational pillars of the discipline. Prominent clusters here include core concepts such as *organizational culture*, *management accounting*, *leadership*, *culture*, and *management control systems*, alongside major institutional contexts like *sustainability*, *china*, and *organizational change*. These topics are indispensable to the field but remain broad in conceptual scope.
- **Niche Themes (Upper-Left Quadrant):** Characterized by high density but low centrality, these comprise highly specialized, isolated research pockets. Key topics include methodological and geographically narrow studies, such as *cultural differences*, *multiple case study*, *germany*, as well as strategic frameworks including *strategic decision making*, *strategic management*, and *competitive advantage*.
- **Emerging or Declining Themes (Lower-Left Quadrant):** Representing low centrality and low density, this quadrant captures developing research fronts or peripheral areas. Notably, it contains emerging technological and methodological frontiers – including *artificial intelligence*, *cross-cultural*, and *ethics* – as well as methodological synthesis clusters combining *national culture*, *indonesia*, and *systematic literature review*.

The strategic mapping demonstrates that while traditional accounting and cultural frameworks form the foundational bedrock (Basic Themes), the field is actively driven by performance management (Motor Themes) and is expanding into technology-driven and systematic review paradigms (Emerging Themes).

Synthesis and discussion

Structural evidence from bibliometric mapping

The findings presented in this section address the second research objective outlined at the outset of this study: establishing whether the field's engagement with culture is genuinely intercultural or predominantly organizational in scope. Three independent bibliometric lenses – trend topic evolution (section *Trend* topics), co-occurrence network mapping (section *Co-occurrence network*), and thematic mapping (section *Thematic map*) – converge on the same structural conclusion: the literature on culture, management accounting, and managerial decision-making is organized around organizational culture as its basic, central theme, while national culture, the field's founding Hofstede-based construct, has become a comparatively peripheral, low-density, emerging-or-declining theme.

This pattern is consistent with a broader, well-documented methodological tendency in management accounting research: it is often more tractable to study how culture shapes accounting practice within a single organizational setting than to design a true cross-country comparative study. The consequence, however, is that a field whose theoretical foundations rest on cross-national cultural variation (Hofstede, Gray) has, in practice, developed a substantial empirical base that speaks primarily to organizational-level dynamics. For a research area framed around intercultural management, this represents a meaningful and underexplored gap: genuinely comparative, multi-country empirical work – explicitly testing how national cultural dimensions shape management accounting practices and managerial decision-making across organizational boundaries – remains a comparatively small, specialized niche within a much larger organizational-culture literature. Specifically, there is a lack of comprehensive research on how intercultural dimensions influence the design and adoption of core management accounting tools. These include performance measurement systems (such as the Balanced Scorecard), cost accounting tools, budgeting and forecasting processes, capital budgeting methods, target costing, and incentive and compensation schemes. Understanding how cultural traits – such as power distance or

uncertainty avoidance – affect the implementation of these instruments is crucial for optimizing financial governance in multinational enterprises.

Research gaps identified in the literature

To complement the structural, network-based evidence presented in section *Structural evidence from bibliometric mapping*, a systematic text-mining scan was conducted across all 483 abstracts in the final corpus, searching for explicit gap-signaling language (e.g., "future research", "lack of", "remains unclear", "gap in the literature", "underexplored", "little is known"). This scan identified 164 gap-signaling statements distributed across 139 records – 29% of the corpus – providing an independent, author-stated line of evidence for the field's own perceived shortcomings, distinct from but consistent with the structural pattern identified through trend topics and network analysis.

Absence of genuinely comparative, multi-country research designs

One of the most recurring calls in the corpus is for research designs that extend beyond a single national or organizational setting. Yousef and Sponem (2026) call explicitly for "comparative studies across different countries or regions" in the adoption of management accounting innovations. Theodorsson and Dosanjh (2026) call for research into non-Western contexts and for integrative theories linking individual-, organizational-, and societal-level perspectives. Song et al. (2025) recommend "cross-cultural and multi-level analytical frameworks", while Ardiana et al. (2026) call for adapting their findings "to different cultural and organisational environments". Choudhary et al. (2026) go further, explicitly identifying research gaps intended to "enhance cross-cultural management theories". Most directly, Wulf et al. (2020) report that "whether and how this framing effect differs among executives from different national cultures remains unclear" – a statement that corroborates, from within a single primary study, the exact structural gap identified independently through the thematic mapping in section *Thematic map*.

Artificial intelligence and digital technology as an emerging, underexplored frontier

Consistent with the trend-topic evolution reported in section *Trend topics*, sixteen gap statements concern the integration of artificial intelligence and digital technologies into culturally embedded accounting and decision-making practices. Al Sulaity et al. (2025) frame AI implementation in the UAE oil and gas sector as bridging both regional and practical research gaps. Machado and Ferreira (2026) identify financial, data-privacy, and technical-expertise barriers to AI adoption among SMEs as an underexplored area requiring structured frameworks. Chishty et al. (2025) note that the moderating role of cultural distance in AI-enabled export performance "remains underexplored", while Aiudi et al. (2026) explicitly position AI-enabled strategic decision-making in SMEs as an "underexplored context".

Underrepresented sectors and regions

A further cluster of gap statements concerns sectors and regions that remain thin in the literature relative to their practical importance. Small and medium-sized enterprises are repeatedly flagged as understudied (Sonar et al., 2025; Rawdhan & Kaliappen, 2024). Public-sector accounting is similarly underrepresented: Zarei et al. (2022) note that "despite cultural dimensions being included in hundreds of business and management research studies, there have been relatively few studies in public-sector accounting that include the use of cultural dimensions", a gap echoed by Harahap (2021) and Aladwan and Alrababah (2025). Emerging-market and developing-country contexts also feature prominently: Elmakkawy et al. (2025) address organizational ambidexterity in the Egyptian luxury hotel sector as an underexplored intersection; Odesola (2025) examines religiosity and SME performance in Nigeria as filling "a significant knowledge gap"; and Sabary and Ključnikov (2023) document the cultural and institutional barriers facing Asian immigrant entrepreneurs in Germany.

Methodological reliance on cross-sectional, single-context designs

A recurring methodological gap concerns the field's continued reliance on cross-sectional, single-country case studies at the expense of longitudinal and

mixed-methods designs. Conde (2025), Xu et al. (2024) each call explicitly for longitudinal designs to validate and extend cross-sectional findings; Palale and Ishida (2024) call for mixed-methods approaches gathering diverse perspectives across countries; and Sánchez-Peinado and Escribá-Esteve (2025) recommend triangulating self-reported measures with objective indicators and exploring alternative cultural models. Taken together, these statements suggest that the empirical base of the field, while substantial in volume, remains methodologically shallow in the dimension that would be most necessary to establish genuinely cross-cultural, causal claims.

Narrow, unresolved gaps within the management accounting core

Finally, several gap statements point to specific, unresolved questions within the management-accounting-specific core of the literature. Li et al. (2023) report that "little is known about how the use of [performance] metrics differs in organizations with varying dependencies on incremental and radical innovation". Alkaraan (2020) finds "a lack of evidence in the literature about how companies approach strategic decision-making regarding divestments of some of their strategic investments". Dimes and de Villiers (2020) note that, despite repeated calls for research on the practical implementation of integrated thinking, "this has not been studied extensively". These narrower gaps offer concrete, tractable starting points for future empirical work that would simultaneously advance the management-accounting core of the field and its underdeveloped cross-national comparative dimension identified in section *Structural evidence from bibliometric mapping*.

Limitations and future research

As with any bibliometric study, this analysis is subject to several limitations. First, the corpus is restricted to Scopus-indexed, English-language, peer-reviewed articles and reviews; relevant work published in other languages, in book

chapters, or indexed exclusively in other databases (e.g., Web of Science) is not represented. Second, the title/abstract and full-text screening stages (section *Corpus construction and screening*) were conducted using a systematic keyword-based heuristic rather than a manual, line-by-line review of all 1,587 records; while this approach is transparent, reproducible, and grounded in explicit inclusion/exclusion criteria, it may have misclassified a small number of borderline records.

Building on the central finding of this study, future research should prioritize explicit, multi-country comparative designs that test how national cultural dimensions (Hofstede, Gray) shape management accounting practices and managerial decision-making across organizational boundaries, rather than continuing to rely predominantly on organizational-culture proxies for what is fundamentally framed in the literature as a national-culture phenomenon.

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Justyna Fijałkowska
SAN University, Poland
jfijalkowska@san.edu.pl
University of Lodz, Poland
justyna.fijalkowska@eksoc.uni.lodz.pl

Cultural Aspects of Accounting: Insights from the Hofstede, Gray and Belkaoui Frameworks

Abstract

Objective: The aim of this article is to explain how national culture shapes the development, form and practice of accounting systems, and to present, in a synthetic and comparative way, the principal theoretical frameworks that explain the relationship between culture and accounting.

Methodology: The paper is based on a critical review and synthesis of the international and Polish literature devoted to the cultural determinants of accounting, with particular attention to the frameworks proposed by Hofstede, Gray and Belkaoui, complemented by a comparative analysis of the Anglo-Saxon and Continental accounting models and of the main areas in which cultural diversity affects accounting practice.

Findings: National culture shapes the legal, political, social and economic environment within which accounting operates, while accounting itself performs a culture-forming function. Hofstede's four dimensions of national culture (power distance, uncertainty avoidance, individualism–collectivism, masculinity–femininity) underlie Gray's four accounting values (professionalism vs. statutory control, uniformity vs. flexibility, conservatism vs. optimism, secrecy vs. transparency), which in turn help explain observable differences between the Continental and Anglo-Saxon accounting models. Belkaoui's model of cultural relativism and his work on the linguistic shaping of accounting add further explanatory depth, particularly regarding cross-cultural interpretation of accounting language and international standards. Cultural diversity continues to affect financial disclosure, audit judgement, management style, organisational culture, accounting ethics and the interpretation of IFRS, and remains a significant constraint on full international harmonisation.

Value Added: The article brings together, in a single English-language synthesis, three of the most influential theoretical traditions explaining the cultural determinants of accounting – Hofstede, Gray and Belkaoui – together with the Anglo-Saxon/Continental model comparison, making this body of knowledge more accessible to an international audience of researchers, educators and standard-setters.

Recommendations: Standard-setters, auditors, educators and practitioners engaged in cross-border financial reporting should explicitly take cultural determinants into account when interpreting and applying international accounting standards; further comparative empirical research is recommended on the influence of culture on the interpretation of IFRS terminology and on disclosure practice.

Key words: culture, accounting, Hofstede, Gray, Belkaoui, harmonisation, international accounting standards

JEL codes: M41, M14, M48

Introduction

Culture, as an element of national identity, affects every dimension of human activity, including economic activity. The culture of a given country shapes the legal, political, social and economic environment within which accounting performs its functions (Koleśnik, 2010). Accounting is an information system reflecting the effects of human economic activity, and it therefore remains under the influence of culturally conditioned human behaviour (Fijałkowska, 2017). At the same time, to a certain extent, accounting itself performs a culture-forming function: it is not merely a model of valuation, recording and communicating the results of social activity, but above all a social science, one that develops in interaction with society and, in turn, affects society (Jaruga & Fijałkowska, 2006). Accounting is a product of the environment in which it is embedded (Perera, 1989), and it is also the language of business – a means of communication within economic activity that is, as Hausner et al. (2013) emphasise, strongly culturally conditioned.

The development of accounting is not uniform across the globe. Local conditions, often rooted in cultural differences, exert a fundamental influence on the evolutionary path of national accounting systems. Culture shapes an

individualised environment by defining social norms and values that, in turn, influence accounting as a system of measurement and disclosure. Financial reporting is never a purely technical exercise: the choices embedded in an accounting system – what is measured, how prudently it is valued, how much is disclosed and to whom – all carry the imprint of the society in which that system developed. Understanding these cultural roots is not merely of academic interest; it has direct practical relevance for standard-setters seeking genuine international comparability, for auditors and preparers operating across borders, and for educators training the next generation of accountants to work in multicultural environments.

Against this background, the objective of this article is to explain how national culture shapes the development, form and practice of accounting systems, and to present, in a synthetic and comparative way, the principal theoretical frameworks that account for the relationship between culture and accounting. Methodologically, the article is based on a critical review and synthesis of the international and Polish literature devoted to the cultural determinants of accounting, with particular attention to the frameworks proposed by Hofstede, Gray and Belkaoui; this is complemented by a comparative analysis of the Anglo-Saxon and Continental accounting models and of the main areas in which cultural diversity affects accounting practice, and is further updated with recent bibliometric and empirical evidence published since these frameworks were first formulated.

The remainder of the article is organised as follows. Section *The Relationship between Accounting and Culture* discusses the general relationship between accounting and culture, drawing on both the Polish and international literature. Section *Hofstede's Cultural Dimensions* presents Hofstede's four dimensions of national culture, together with his classification of countries. Section *Gray's Theory of Accounting Values* turns to Gray's theory of accounting values, linking it to Hofstede's dimensions and to recent empirical and bibliometric evidence on its continued validity. Section *Belkaoui's Concepts: Cultural Relativism and Linguistic Relativism* discusses Belkaoui's concepts of cultural relativism and linguistic relativism. *Section Cultural Variables in the Anglo-Saxon and Continental Accounting Models* compares the cultural variables underlying the Anglo-Saxon

and Continental accounting models. Section *Main Areas of Difference Resulting from Cultural Diversity* reviews the main areas of accounting practice – disclosure, audit, management style, ethics and IFRS interpretation – in which cultural diversity continues to leave its mark. Section *Harmonisation and Standardisation versus Cultural Diversity* examines the tension between cultural diversity and the international harmonisation and standardisation of accounting. The article closes with conclusions and recommendations for standard-setters, educators and future research.

The Relationship between Accounting and Culture

The links between culture and accounting have been the subject of extensive analysis both in the Polish and in the international literature. Kamela-Sowińska (2006) stresses that an accounting system must reflect the postulates of the culture from which it has grown, and that before any opinion is formed about accounting as a system, it is essential to understand the background against which that system developed. Adamek (2009) similarly observes that culture, as an element of national identity, is directly reflected in the dimensions of human activity, including economic activity, and in the scope of the numerical disclosures that accounting produces. Koleśnik and Silska-Gembka (2012) add that it is precisely culture, as an element of national identity, that creates the legal, political, social and economic environment within which accounting performs its functions.

Dobija (2003) notes that accounting develops together with society, producing the variant of settlement optimal for society's stage of development. According to Perera (1989), accounting, as a product of human activity, continuously influences decisions on the application of accounting concepts and principles; culture thus becomes one of the most important environmental factors affecting accounting practice, in particular with respect to the norms and values shared by members of a given accounting system (Doupnik & Salter, 1995). As early as 1968, Mueller pointed to significant differences between accounting systems rooted in

different cultures, and the recognition that cultural values affect many aspects of accounting has since become fundamental to the discipline. Jaggi (1975) argued that every culture should develop its own accounting system, suited to its own particular purposes, while Doupnik and Salter (1995) maintained that where economic, political and cultural differences exist between countries, accounting practices should differ accordingly. Zarzeski (1996) showed how accounting practices differ across cultural environments as a result of differing patterns of business-relationship development, and Violet (1983), one of the first researchers of the influence of culture on international accounting, described accounting as "a product of its culture". Schreuder (1987) further identified distinct research cultures in accounting in Europe and the United States.

Hofstede's Cultural Dimensions

Hofstede is regarded as the pioneer of research into the influence of cultural factors on accounting systems. He defines culture as the collective programming of the mind that distinguishes the members of one group from another; culture, so understood, encompasses value systems, and values are among the building blocks of culture (Hofstede, 1980). Hofstede's research, conducted from the 1970s onward, contributed significantly to understanding why the form, content and institutional solutions of accounting differ across countries. In 1980, he proposed four dimensions of national cultural values:

- **Power distance** – the degree to which people accept that power in a state and its institutions is not distributed evenly; it expresses how a society deals with inequality among its members.
- **Uncertainty avoidance** – the extent to which a society seeks to guard against unforeseen events and is reluctant to take risky decisions (creating strict rules and procedures), as opposed to societies that accept unpredictability and are more willing to take risks.
- **Individualism vs. collectivism** – the strength of social ties; individualism favours loose social bonds and greater individual responsibility, while

collectivism entails tight social bonds, shared responsibility and loyalty to the group.

– **Masculinity vs. femininity** – the relative prevalence of "masculine" traits (assertiveness, achievement, material success) or "feminine" traits (modesty, care for others, concern for relationships) in a given society.

Combining the first two dimensions yields four combinations of countries, as originally presented by Hofstede in 1980 and summarised in Table 1.

Table 1. Classification of countries by cultural difference according to Hofstede (1980)

	Small power distance	**Large power distance**
Weak uncertainty avoidance	Market-driven organisations: Denmark, Sweden, Iceland, UK, USA, Canada, South Africa, Australia, Netherlands, Norway, New Zealand	Personal bureaucracy, "family" model: Singapore, Hong Kong, India, Malaysia, Philippines, Indonesia, East and West Africa
Strong uncertainty avoidance	"Well-oiled machine" organisations: Switzerland, Finland, Germany, Austria, Israel	Full, pyramid-shaped bureaucracy: Iran, Pakistan, Thailand, Taiwan, Ecuador, Arab countries, Italy, Argentina, Spain, Brazil, Turkey, France, Mexico, Venezuela, Panama, Yugoslavia, Japan, Belgium, Guatemala, Portugal, Greece

Source: Own elaboration based on Hofstede (1980).

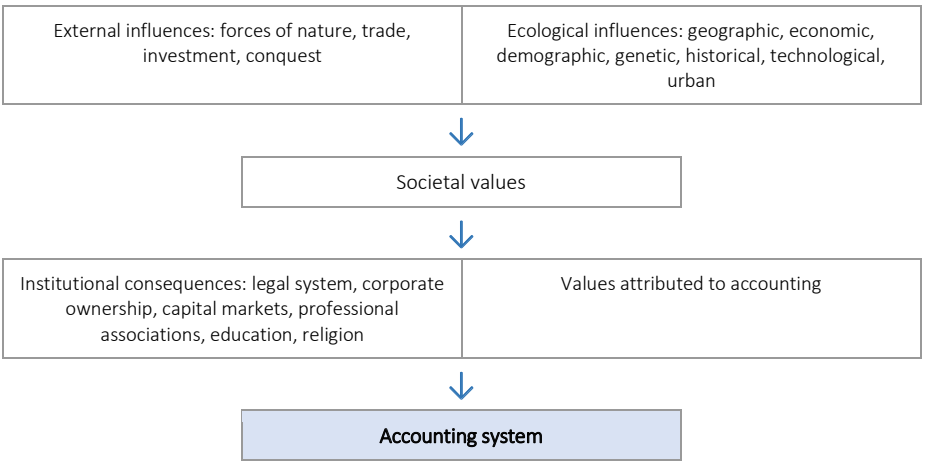
According to Hofstede (1980), societies are shaped by different environmental and technological factors and therefore develop different social values, which in turn affect institutional processes. It follows that each culture may develop its own accounting system, suited to its own needs and distinct from those of other groups with different social values. Hofstede's work remains the most comprehensive account of the influence of national culture identified to date (Doupnik & Tsakumis, 2004).

Gray's Theory of Accounting Values

Gray's (1988) work marked a breakthrough in research on the cultural determinants of accounting. Gray assumed a close relationship between social values and the shape and direction of development of an accounting model, positing that national culture determines and permeates the subcultures it gives rise to – including the accounting subculture. External and ecological influences, transmitted through social values, generate the differentiated values attributed to accounting and thereby give rise to different accounting systems around the world.

Gray represented this chain of influence in a conceptual model linking external and ecological influences, through societal values and institutional consequences, to the values attributed to accounting and, ultimately, to the accounting system itself, as summarised in Figure 1.

Figure 1. Culture and societal values vs. the accounting subculture



Source: Own elaboration based on Gray (1988, p. 7).

Linking Hofstede's dimensions (power distance, uncertainty avoidance, individualism and masculinity) to the values of the accounting subculture, Gray identified four bipolar cultural attributes that can be assigned to accounting, summarised in Table 2.

Table 2. Cultural attributes and accounting

Cultural / accounting value	Characteristics
Professionalism vs. statutory control	In societies marked by uncertainty avoidance, collectivism and acceptance of inequality, accounting is closely regulated by statute. In countries with the opposite traits, accounting is shaped largely by professional accounting bodies.
Uniformity vs. flexibility	A preference for uniform, unchanging accounting rules is found in societies with large power distance and high uncertainty avoidance, whereas openness, individualism and risk-taking increase the likelihood of flexible accounting rules.
Conservatism vs. optimism	Conservatism is linked to risk aversion and its avoidance; risk is more readily accepted in societies with a more optimistic orientation. Both attributes relate to measurement and valuation approaches.
Secrecy vs. transparency	Transparency characterises accounting models with extensive disclosure, both mandatory and voluntary; secrecy is associated with limiting disclosure to what is strictly required.

Source: Own elaboration based on Hajduka (2011).

On the basis of these attributes, the accounting characteristics of individual world regions can be described, as illustrated in Table 3.

Table 3. Characteristics of accounting in selected world regions

Region	Professionalism	Flexibility	Conservatism	Transparency
Developed Romance countries (Belgium, France, Argentina, Brazil, Spain, Italy)	Moderate	Low	High	Moderate
Developed Asian countries (Japan)	Moderate state control	Low	High	Moderate
Middle Eastern countries (Arab countries, Greece, Iran, Turkey, former Yugoslavia)	Strong state control	Very low	Moderate	Low
German-speaking countries (Austria, Germany, Switzerland, Israel)	Moderate	Moderate	High	Low

Region	Professionalism	Flexibility	Conservatism	Transparency
Anglophone countries (Australia, Canada, Ireland, New Zealand, UK, USA, South Africa)	High	High	Low	High
Nordic countries (Denmark, Finland, Norway, Sweden, Netherlands)	Moderate	Moderately high	Low	Moderately high

Source: Own elaboration based on Hajduka (2011, p. 114), after Mućko (2009) and Kortum (2001).

On this basis, more developed countries tend to show a high or moderate status of accounting professionals and correspondingly low state control over accounting regulation; they are more flexible in the application of accounting principles, show a more optimistic approach, a greater propensity for risk and a wider scope of disclosure in financial reporting. Less developed countries, by contrast, tend to show moderate to extensive state control, a smaller role for professional bodies in regulating accounting, low flexibility, moderate to strong conservatism, and more limited disclosure. Table 4 summarises how Gray's four accounting values relate to Hofstede's underlying cultural dimensions, where "+" denotes a direct relationship, "–" an inverse relationship, and "?" an undetermined relationship.

Table 4. Linkage between Gray's and Hofstede's concepts

	Power distance	Individualism	Masculinity	Uncertainty avoidance
Conservatism	+	–	?	+
Uniformity	+	–	?	+
Professionalism	–	+	?	–
Secrecy	+	–	–	+

Source: Own elaboration based on Chanchani & MacGregor (1999) and Baydoun & Willett (1995).

A recent large-scale test of these relationships outside the Western context supports several of these hypothesised linkages: Zahid et al. (2024), surveying 842 preparers and users of financial statements in China, found that low uncertainty avoidance, high power distance, collectivism, Confucian long-term

orientation and masculine cultural traits jointly produce a strong preference for uniformity, conservatism and secrecy in Chinese financial reporting, together with comparatively weak professionalism – a pattern broadly consistent with Gray's original hypotheses.

The continued relevance of the Hofstede-Gray framework is demonstrated in a recent bibliometric and systematic literature review by Maocha and Albuquerque (2025). Analysing seventy studies published between 1988 and 2024 in Scopus- and Web-of-Science-indexed journals using the PRISMA protocol, VOSviewer, and Bibliometrix, the authors show that the model remains widely used and has been progressively adapted to new contexts and accounting phenomena. This is the case even though, as noted above, no full consensus has yet been reached on its validity and explanatory scope.

Empirical verification of Gray's theory has, however, produced mixed results. Reviewing eight international studies, Adamek (2011) concluded that there was no clear confirmation of the links posited between Hofstede's cultural values and Gray's accounting-subculture attributes. Nevertheless, the absence of consistent correlations does not undermine the broader thesis of the cultural contingency of accounting and its diversity, viewed from the standpoint of cultural relativism. Gray's work is nonetheless widely regarded as pioneering in the development of the idea that culture influences accounting practice (Jaggi & Low, 2000; Tsakumis, 2007; Zarzeski, 1996). Baydoun and Willett (1995) offered a critical extension of Gray's theory, arguing that certain technical aspects of accounting also carry cultural significance and should be incorporated more formally into any model of culture's influence on accounting. Specifically, they stressed the need to distinguish between measurement and reporting issues, noting that the more accounting is determined by physical factors, the smaller the influence of culture. Conversely, the more it is shaped by social factors – as in financial-statement disclosure – the greater that influence becomes.

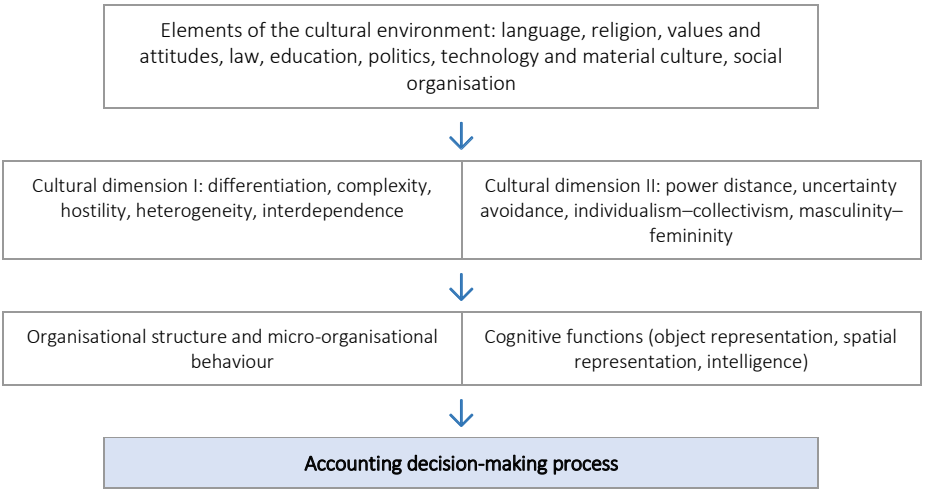
Belkaoui's Concepts: Cultural Relativism and Linguistic Relativism

Belkaoui proposed two further, complementary perspectives on the significance of cultural factors for accounting. The first concerns a model of cultural relativism (Belkaoui, 1990); the second concerns the dimension of linguistic difference as a fundamental element of culture and its influence on accounting (Belkaoui, 1995).

Cultural relativism

Belkaoui's model of cultural relativism holds that culture may take on different dimensions depending on its degree of diversity, complexity, hostility, heterogeneity and interdependence. The first three describe features internal to a given culture, while the latter two describe its relations with other cultures. Together, these five dimensions create a distinctive cultural environment, which – together with Hofstede's national cultural values – gives rise to different "arenas" of culture. These cultural processes influence decision-making within the accounting system, since culture, operating through several levels of influence, determines organisational structure, micro-organisational behaviour and the cognitive functioning of individuals, all of which in turn affect decision-making in accounting and auditing, as summarised in Figure 2.

Figure 2. Cultural relativism and the accounting decision-making process



Source: Own elaboration based on Belkaoui (1990, p. 41).

Linguistic relativism

Focusing on the influence of language, Belkaoui (1990) argued that linguistic diversity shapes cognitive structures and thereby affects decision-making in accounting. From this perspective, he regarded accounting itself as a unique form of language. Individual behaviour is grounded in a relative understanding of certain lexical distinctions and grammatical rules that affect behaviour in accounting-related activities. Belkaoui further noted that bilingualism increases mental flexibility and cognitive capacity, as well as a predisposition to logical thinking, and on this basis called for accounting professionals to learn foreign languages. The metaphor of accounting as "the language of business" has been echoed by other scholars: Tanaka (1982) observed that accountants attempt to map certain economic events of an entity in a unique way that can be called the language of accounting, while Ijiri (1975) noted that, as the language of business, accounting shares many features with other languages, representing the diverse economic activities of firms in much the way that newspapers represent news of events.

Cultural Variables in the Anglo-Saxon and Continental Accounting Models

Cultural diversity across the world's regions can be treated as a decisive factor behind the divergence of accounting models associated with different cultures (Biadacz, 2016). These models are determined by underlying worldviews that shape perceptions of the role of the market, legal norms and the principles and functions of accounting. Among the various classifications of accounting models, the distinction between the Continental and the Anglo-Saxon (Anglo-American) model deserves particular attention; the principal differences between them are summarised in Table 5.

Table 5. The Continental and Anglo-Saxon accounting models against cultural differences

Environmental variable	Continental model	Anglo-Saxon model
Capital market (main source of capital)	Banks, financial institutions	Stock exchanges
Cultural	State orientation; risk and uncertainty avoidance; conservatism; small individualism	Individualism, small power distance; openness to risk; flexibility
Legal system	Statutory law; accounting rules set by statute	Common law; standards set by professional bodies
Tax system	Close linkage between tax law and accounting law	Tax law separated from accounting rules
Primary users	Creditors, tax authorities, shareholders, employees	Mainly investors
Dominant principle	Prudence	True and fair view, substance over form
Disclosure level	Limited	Extensive
Example countries	Belgium, Germany, France, Greece, Italy, Spain, Poland, Portugal, Switzerland, Hungary	UK, Netherlands, USA, Canada, Australia, New Zealand, Singapore, Anglophone Africa

Source: Own elaboration based on Jaruga (2002).

This division corresponds to two broader groups of countries – credit/tax-oriented countries and countries with developed capital markets (Jaruga,

2002) – resting on two legal traditions: codified law and common law. The Anglo-American model is regulated by standards set by professional accounting organisations, oriented towards the capital market and relies on raising capital from external investors; it places the main emphasis on the transparency and reliability of financial statements. The Continental model, developed within a different culture, places less emphasis on the transparency of financial statements and more on compliance with legal requirements; the information contained in financial statements is oriented more towards creditors than towards investors.

The Continental model exerted significant influence on the course of accounting harmonisation within the European Union, while the development of International Accounting Standards/International Financial Reporting Standards has proceeded, and continues to proceed, largely under the influence of the Anglo-Saxon model (Jaruga, 2006). It was in Anglo-Saxon countries that the flexible, pragmatic accounting standards developed that, particularly after 2005, became the basis for accounting disclosure in many enterprises worldwide, as a result of the increasingly widespread standardization and harmonization of accounting aimed at reducing differences rooted, to a considerable degree, in cultural differences between nations. As Śnieżek and Piłacik (2014) observe, however, intensifying economic phenomena and processes in recent years have made the sharp separation of these two models increasingly untenable, as globalization drives a process of convergence – the mutual permeation, blending and transformation of the prevailing models.

Main Areas of Difference Resulting from Cultural Diversity

Cultural determinants help explain differences in the approaches, methods and regulations applicable to various aspects of accounting. The literature has identified a number of areas whose shape is influenced by cultural factors and which have a direct bearing on accounting systems (Fijałkowska, 2017):

- **Financial disclosure.** The information content disclosed in financial reporting depends heavily on cultural factors. Countries with a strong propensity for uncertainty avoidance and large power distance tend to limit disclosure to information that is necessary and mandatory, whereas companies from more individualist cultures tend to disclose more extensively, reflecting a greater tendency to build open relationships with their environment; similarly extensive disclosure is characteristic of societies with a predominance of "masculine" traits (Zarzeski, 1996; Tsakumis, 2007; Hope, 2003; Jaggi & Low, 2000). Gray's secrecy dimension continues to shape voluntary, non-financial disclosure well beyond traditional financial reporting. Studying companies awarded S&P Global Sustainability Awards in twenty-four countries between 2015 and 2019, Boonlert-U-Thai et al. (2025) found that firms based in strongly religious countries are less likely to have their corporate social responsibility reports independently assured, that this effect is amplified in secrecy-oriented cultures, and that highly religious firms operating within secrecy cultures nonetheless tend to favour audit firms specifically as their CSR assurance providers. This extension of cultural analysis into non-financial and sustainability reporting is itself becoming a distinct research stream. Reviewing sixty Scopus-indexed studies published between 1999 and 2024, Cannizzaro and Quarchioni (2026) organise this literature around three stages of non-financial reporting – adoption, content and assurance – and conclude that, although the field is expanding rapidly, the evidence on how national culture shapes non-financial reporting remains fragmented, pointing to a clear agenda for future research.
- **Audit.** In countries with large power distance, auditors face considerable pressure from clients when forming their opinions and often feel obliged to maintain good relationships with a client's management. Research shows that both power distance and the manifestation of individualism affect the incidence and location of accounting errors: material misstatements tend to be more common in societies with large power distance, where power is often concentrated in few hands, while in more decentralized societies with smaller power distance there is typically greater

precision, control and transparency, and material misstatements occur less frequently (Cohen et al., 1993; Chan et al., 2003; Hope et al., 2008).

- **Management style and organisational culture.** Management style significantly affects the behaviour of accountants and the practices and choices they make; inappropriate motivation and reward systems can lead to improper or unethical behaviour, including the disclosure of inaccurate information, whereas management styles that emphasise appropriate professional values motivate accountants to provide reliable and complete information. Organisational culture, in turn, permeates every aspect of an organisation and influences decisions and judgements in accounting and auditing, as well as the independence and objectivity of accountants and auditors (Hofstede, 1984; Chow et al., 2002; Maali & Napier, 2010).
- **Ethics and taxation.** Cultural characteristics associated with imprecise, non-sanctioning legislation in some countries have been identified as a source of distortion in accounting and tax ethics (Zabłocka, 1999).
- **IFRS implementation and interpretation.** Implementing IFRS in national accounting systems requires an organisational culture based on cooperation and a shared sense of purpose; culture also shapes the acceptance of imposed rules and standards (Kabalski, 2005, 2012; Neidermeyer et al., 2012; Zeghal & Mhedhbi, 2006). Difficulties in finding equivalent terms and translation inconsistencies, together with cultural variation in the interpretation of probability expressions used in IFRS, mean that accountants from different cultures interpret and apply international standards in non-uniform ways (Gierusz et al., 2014; Doupnik & Richter, 2004; Doupnik & Riccio, 2006).

Harmonisation and Standardisation versus Cultural Diversity

Advancing globalization drives the unification of accounting systems worldwide. The divergent development of accounting rules and practices across countries, to a considerable extent rooted in differences of cultural context, has directly motivated efforts to unify and standardise these rules so that accounting can serve as a genuinely international language of business, understood by its users regardless of origin. As Jaruga (2002) explains, international harmonisation of accounting refers to a movement towards similarity in the choice among alternative accounting solutions, whereas standardisation is a process that narrows choice, ultimately leading all firms in all countries to adopt the same accounting method.

The potential benefits of international standards include greater comparability of financial data for investors, increased readiness to invest across borders, lower cost of capital, more efficient resource allocation and higher economic growth (Jaruga et al., 2007, Fijałkowska et al., 2007). In theory, the transition to IFRS leads to the adoption of an international language understood by the global market (Fijałkowska & Jaruga-Baranowska, 2007). In practice, however, as Gierusz et al. (2014) note, one cannot assume that everyone understands the same terms in the same way: their study of the influence of culture on the interpretation of IFRS in Poland shows that cultural differences can lead accountants in different countries to interpret the same standard differently, which may adversely affect the cross-cultural comparability of financial statements.

The practical, educational dimension of this challenge is illustrated by Nguyen et al. (2025), who studied long-term foreign accounting educators teaching on transnational branch campuses in Vietnam ahead of the country's scheduled shift from national accounting standards to IFRS, finding that cultural intelligence developed through sustained immersion in the local academic community was the primary pathway enabling these educators to adapt their teaching practices to a culturally diverse student population – a reminder that successful cross-border harmonisation depends not only on converging technical standards but also on building the cross-cultural competence of those who teach and apply them.

This raises the question, posed among others by Koleśnik and Silska-Gembka (2012), of whether accounting regulations rooted in the Anglo-American tradition can really be applied across different cultural circles, and whether they can be implemented not only in large entities but also in smaller entities from the SME sector. Moreover, Krasodomska (2010) observes that cultural, institutional, political and tax conditions, as well as the level of development of financial markets and education, differ between countries and will remain different; this raises another doubt as to whether it is appropriate to assume, top-down, that accounting rules established outside a given country will necessarily be better than those that grow out of its own local environment. Gierusz (2015) lists persistent cultural differences between countries – including those within the European Union – among the principal factors limiting the progress of harmonisation, since they complicate the introduction of IFRS into national legal systems; Kamela-Sowińska (2013), analysing the direction of accounting integration in the EU, likewise points to the need to strengthen the role of national standard-setters, since only a national standard-setter can incorporate the cultural elements and experience of a given country into its standards.

Conclusions

The state of contemporary accounting, and the changes it continues to undergo, result from the interaction of many factors: historical conditions, changes in legal regulation, globalisation, the development of communication and data-processing technology and the growing importance of harmonisation and standardisation. Among these factors, cultural conditions play a fundamental role, both as a product of the other factors shaping the development of accounting and as an influence on the shape of those very factors. Biadacz (2016) stresses that culture, as an element of national identity, alongside such components as the legal and economic system, the level of development of financial markets, or historical experience, plays a very important role in shaping the expectations

placed on accounting functioning within a given cultural environment, while also influencing the ways in which the tasks set for accounting are carried out.

As Jaruga (2002) observed, an accounting system reduces uncertainty, thereby fulfilling a cultural need for certainty, simplicity and truth, irrespective of whether that truth has an objective basis – which may explain the frequent lack of consensus between countries as to which accounting methods are appropriate under given conditions. Cultural values, formed within a given social context over centuries, remain remarkably stable and unchanging over time; despite technological progress, closer ties between countries, and the movement of people, goods and capital, certain cultural distinctions persist. It is precisely these values that most strongly influence the application and interpretation of accounting regulations, including international ones; they shape the language of accounting and determine the ultimate information content of financial reporting. They also affect the behaviour of accountants and auditors, their relations with management, and the reliability, transparency, objectivity and integrity of accounting judgements, decisions and disclosures, which permeate many dimensions of the functioning of society as a whole. Awareness and systematic knowledge of cultural differences should therefore be regarded as fundamental to interpreting and understanding the language and practices of accounting across different cultural circles – an awareness and expertise of particular relevance to standard-setters, educators and practitioners engaged in cross-border financial reporting and audit. Furthermore, in an era dominated by digital transformation, big data and artificial intelligence in financial systems, a key question for future inquiry is whether technology will homogenise accounting practices globally, or if cultural values will continue to dictate how these advanced tools are implemented and interpreted by decision-makers. Additionally, as the landscape of accounting rapidly expands to incorporate non-financial and sustainability reporting (ESG), examining how cultural dimensions influence the quality, transparency, and 'connectivity' of these disclosures represents a vital and promising avenue for future research. Finally, as global standard-setters strive for unified sustainability and financial reporting standards, future studies should investigate the friction between standardised global frameworks and deeply ingrained local cultural norms to prevent superficial, purely symbolic compliance.

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Nasser Bouchareb
Ferhat Abbas University Setif 1, Algeria
Nacir007@yahoo.fr

Ismail Morad
University of Ain Temouchent, Algeria
morad.ismail@univ-temouchent.edu.dz

Yacine Herizi
University Mohamed El Bachir El Ibrahimi of Bordj Bou Arreridj, Algeria
Yacine.herizi@univ-bba.dz

Data Treatment, Consumer Profiling, and Privacy: Toward a Unified Conceptual Framework

Abstract

Objective: To develop a unified conceptual framework explaining how AI-driven data treatment (collecting, integrating, transforming, and inferring from consumer traces) produces consumer profiles, and how those profiles translate into distinct privacy impacts, while showing where governance controls can intervene.

Methodology: A conceptual, theory-building approach that synthesizes insights across marketing, information systems, and privacy/AI governance literature to model privacy risk as a mechanism chain: data treatment dimensions, profiling intensity, privacy impacts, with governance operating as a moderating layer across the chain.

Findings: The paper identifies a small set of structural dimensions that largely determine privacy risk: the extent to which data are linkable across contexts, the depth of inference, the persistence of representations over time, and the degree of coupling to consequential actions. These dimensions shape profiling intensity (granularity, profile stability, automation, actionability) and generate multiple harm pathways – informational, autonomy-related, distributive/fairness-related, and security-related – whose severity increases when systems are opaque and hard to contest.

Value Added: The paper offers a parsimonious vocabulary that connects upstream data practices to downstream harms via profiling intensity, helping researchers and practitioners move beyond narrow "consent/anonymization" framings and better diagnose *why* privacy harm can occur even when data are legally obtained or "de-identified".

Recommendations: Firms should limit high-risk profiling by reducing inference depth, cross-context linkage, and persistence, and by making consequential profiles transparent and contestable; regulators should focus on enforceable rules for transparency/contestability and restrict high-impact profiling; researchers should operationalize key constructs (e.g., inference depth, persistence, actionability) and test the framework empirically across sectors.

Key words: data treatment, consumer profiling, AI governance, privacy harms, contextual integrity, algorithmic decision-making, digital marketing

JEL codes: M31, L86, D83

Introduction

Artificial intelligence (AI) has become a central infrastructure for contemporary consumer understanding. Across digital platforms and data brokerage ecosystems, firms increasingly rely on "data treatment", the systematic collection, integration, transformation and analysis of heterogeneous data traces, to infer preferences, predict behavior, and optimize decision-making at scale. These practices promise efficiency and relevance through personalization, recommender systems, dynamic pricing, fraud detection, and targeted advertising. Yet the same pipeline that converts raw traces into actionable insight also expands the privacy surface of consumer life: it increases the volume of data processed, deepens the inferential reach of analytics, and amplifies the capacity to classify individuals into consequential categories that shape opportunities, information exposure, and market treatment.

Existing privacy debates often focus on discrete issues, notice-and-consent, anonymization, data minimization, or cybersecurity, without fully accounting for the way profiling emerges from the end-to-end treatment of data. In practice, the privacy risk is not limited to the disclosure of explicit identifiers; it also arises from the production of *inferred attributes*, the recombination of seemingly innocuous datasets, and the persistence of profiles that outlive the contexts in which data were generated. Moreover, AI-enabled profiling shifts privacy concerns from individual disclosure to broader socio-technical effects (Mavriki & Karyda, 2019), including autonomy erosion through behavioral targeting, differential treatment via scoring and segmentation, and "group privacy" harms where outcomes are determined by membership in inferred categories rather than by revealed personal facts (Mann & Matzner, 2019). This creates

a conceptual mismatch: traditional privacy framings built around data ownership or secrecy are often ill-suited to explain harms that occur even when data are legally obtained, technically "de-identified", or never directly exposed to third parties.

Against this background, this paper develops a unified conceptual framework that links data treatment practices to consumer profiling dynamics and to privacy impacts. The objective is not to provide a technical taxonomy of machine-learning methods, but to clarify the conceptual mechanisms by which data treatment becomes profiling, and profiling becomes privacy risk. We propose that privacy outcomes are shaped by a small number of analytically separable dimensions, such as the scope and sensitivity of data inputs, the depth of inference enabled by transformations, the granularity and stability of profiles, and the degree to which profiles are operationalized in automated or semi-automated decisions. By articulating these dimensions and their relationships, the framework integrates insights that are often treated in isolation across information systems, marketing, law and policy, and AI ethics.

Although the mechanisms linking AI-driven data treatment, consumer profiling, and privacy harms are broadly applicable across digital markets, their practical implications are shaped by cultural and institutional contexts. Societies differ in their expectations regarding personal privacy, the acceptability of algorithmic profiling, and the level of trust placed in organizations and public institutions. Likewise, regulatory traditions vary considerably in the degree to which they emphasize individual rights, organizational flexibility, or public oversight. Consequently, the governance mechanisms proposed in this framework should not be understood as universally identical in their implementation or effectiveness. Instead, their legitimacy and practical impact are expected to depend on the broader cultural and regulatory environment in which AI-driven consumer profiling occurs.

The paper makes three contributions. First, it offers a precise conceptualization of "data treatment" as a lifecycle of transformations whose privacy implications can exceed those associated with data collection alone. Second, it theorizes consumer profiling as the construction and operationalization of behavioral and categorical representations ("data doubles") and embeds them into market

interactions. Third, it synthesizes major privacy harm pathways, informational, autonomy-related, distributive/fairness-related, and security-related, showing how each can be generated or intensified by particular combinations of treatment and profiling intensity. The framework also yields propositions and a research agenda for future empirical work on when and why AI-driven consumer understanding crosses the threshold from beneficial personalization to privacy-invasive surveillance.

The remainder of the paper first clarifies the meaning and scope of data treatment in AI-mediated consumer analytics, emphasizing how transformation and inference reshape what data "are" in privacy terms. It then examines consumer profiling as a socio-technical practice, how profiles are constructed, stabilized, and made actionable in market settings. Building on these foundations, the paper maps privacy harms and the pathways through which they emerge, before integrating the elements into a unified framework that supports theory development, governance thinking, and a targeted agenda for empirical validation.

Conceptualizing "Data Treatment" in AI Companies

In AI-mediated consumer analytics, *data treatment* is often reduced, especially in legal or operational discourse, to a broad notion of "processing". For theory-building, that definition is too thin. A more analytically useful concept treats data treatment as an end-to-end pipeline of transformation and inference through which organizations convert dispersed traces into decision-relevant knowledge about consumers. The privacy stakes, therefore, are not located only in whether data are collected or transferred, but in how data are rendered comparable, linkable, and predictive, and then embedded into market action. Several works implicitly adopt this pipeline perspective, where firms: Collect and integrate dispersed traces; Transform data into analysis-ready representations; Inference and modeling for consumer understanding; Deployment into decision and action loops.

Table 1. Stages linking dispersed traces to marketing decisions

Pipeline Stage	Consumer-focused Example	Source
Collection & Integration	Online/offline, social, and transaction data unified for big data consumer analytics	(Erevelles et al., 2016; Fernández-Rovira et al., 2021; Kitchens et al., 2018)
Transformation	Pre-processing and feature engineering for customer models	(Giovanelli et al., 2022; Khattach et al., 2025; Sivakolundhu, 2024)
Inference	Segmentation, recommendation, CLV, churn prediction	(Erevelles et al., 2016; Gupta et al., 2020; Kitchens et al., 2018; Kodi, 2024)
Decision/Action	Personalized offers, dynamic pricing, real-time interventions	(Hajli et al., 2020; Khattach et al., 2025; Shah, 2025; Naphade, 2025)

A minimal conceptual model can be expressed through four tightly coupled operations. First, firms capture traces by instrumenting interaction: clicks, dwell time, purchases, device signals, location pings, and customer-service logs (Bujlow et al., 2017; Sakalauskas & Kriksciuniene, 2024; Schweidel et al., 2022). The resulting "raw data" are not neutral; they reflect design choices about what is measurable, which behaviors count as signals, and what remains unrecorded, an insight consistent with scholarship on datafication and platform governance (Gillespie, 2010, 2014; Van Dijck, 2014). Second, traces are standardized and integrated: they are cleaned, normalized, and merged across services, devices, and time (Wang et al., 2014; S. Xu et al., 2015). Identity resolution, whether deterministic (logins, persistent identifiers) or probabilistic (matching and fingerprinting), is pivotal because it converts fragmented episodes into a coherent behavioral narrative. At this point, privacy concerns begin to exceed classic disclosure models: the system can become "person-aware" through linkability even when explicit identifiers are minimized.

Third, integrated traces are converted into representations suitable for computation. This is the move from data as records to data as features: variables, embeddings, segments, and scores that compress complex life into analytic proxies (e.g., "price sensitivity", "likely churn", "affinity for category X") (Bastarache et al., 2022). This representational step is where many privacy issues become structurally "built in", because the consumer is no longer treated as a participant in a transaction but as an object of continuous measurement and prediction.

Fourth, systems produce inferences and activate them: models estimate propensities and classifications, and organizations operationalize them through ranking, targeting, personalization, dynamic pricing, risk scoring, and attention allocation (Ban & Keskin, 2021; Jha et al., 2025). Here, privacy becomes inseparable from power. As theorists of surveillance and market governance have argued, the critical question is not merely what a firm knows, but what it can do with that knowledge to shape exposure, choice architectures, and access to goods or opportunities (Zuboff, 2019).

This pipeline perspective clarifies why privacy cannot be fully assessed at the point of collection alone. Two mechanisms are especially central. The first is context collapse, captured well by Helen Nissenbaum's notion of contextual integrity: information generated in one social setting (browsing, entertainment, health queries, mobility) is made usable in another (advertising, credit-like scoring, eligibility decisions) once it is merged and abstracted (Nissenbaum, 2004). The second is inferential escalation: privacy-relevant attributes may be produced rather than disclosed. In other words, "sensitivity" is not only a property of inputs; it can be an emergent property of the treatment process. This logic also explains why de-identification is an unstable privacy guarantee in rich consumer ecosystems: linkage across datasets and high-dimensional representations can enable re-identification or attribute reconstruction, a recurring lesson in re-identification research associated with (Narayanan & Shmatikov, 2008).

To develop a unified framework linking data treatment to profiling and privacy, it is therefore helpful to characterize treatment not by technical minutiae but by a small set of structural dimensions that shape downstream risk (Quach et al., 2022; Salem et al., 2023). Four dimensions are particularly diagnostic across sectors. Linkability refers to the capacity to merge traces across contexts and identities; it is the main driver of "whole-of-life" visibility (Zheng et al., 2018). Inferential depth captures the distance between what is observed and what is predicted (or imputed) about preferences, vulnerabilities, or life circumstances (Bindschaedler et al., 2018). Persistence describes the temporal reach of stored representations and the extent to which past traces constrain present and future interactions. Operational coupling denotes how tightly inferences are connected to consequential actions, whether predictions merely inform content ordering

or directly gate opportunities, adjust prices, or allocate scrutiny (El Mokhtari et al., 2021; Mustafa et al., 2019). Together, these dimensions explain why two systems may appear similar at the level of "processing" yet differ radically in privacy implications: privacy risk increases as treatment becomes more linkable, more inferential, more persistent, and more tightly coupled to market decisions.

Conceptualizing data treatment in this way positions it as the upstream mechanism through which consumer profiling becomes possible. Profiling is not an optional add-on that occurs after neutral processing; it is the predictable outcome of a pipeline designed to transform traces into actionable predictions. This is precisely why a privacy analysis anchored in data treatment, rather than isolated moments of disclosure, offers a stronger theoretical basis for understanding contemporary AI companies' relationships to consumers.

Consumer Profiling as a Socio-Technical Process

Consumer profiling is commonly described as a technical outcome, "the model's prediction" or "the segment assignment". For a theoretical account, this is insufficient. Profiling is better conceptualized as a socio-technical process that produces *actionable representations* of consumers and embeds them into organizational routines, market infrastructures, and interface environments (Heiberg et al., 2022; Syrjälä et al., 2025; Vespignani, 2012). Profiles are not merely descriptive summaries; they are operational objects that coordinate how firms allocate attention, set terms of exchange, and structure what consumers see, pay, or can access.

A profile emerges when data treatment outputs are translated into stable categories or scores that can travel across decision points. This translation typically involves three interlocking moves. First, the consumer is rendered into a representation (features, embeddings, "propensity", "lifetime value", "risk", "affinity"). Second, that representation is evaluated through ranking or scoring, making the consumer comparable to others in a system optimized for selection. Third, the evaluation is

activated through interventions, recommendations, targeting, friction, prioritization, price steering, eligibility gating, or differential service. The practical meaning of a profile lies in this activation: a profile matters because it changes what the system does to or for the consumer (Barbosa et al., 2021; Trusov et al., 2016).

Profiling is socio-technical because its categories and thresholds are not determined by data alone (Heiberg et al., 2022; Syrjälä et al., 2025; Vespignani, 2012). They reflect organizational objectives (growth, retention, risk reduction), institutional constraints (compliance, reputation), and the economic logic of platform ecosystems (advertising auctions, recommender optimization, brokerage). What appears as a neutral prediction is therefore shaped by design decisions: what counts as a "conversion", which outcomes are rewarded, which proxies are acceptable, how long histories are retained, and where uncertainty is tolerated. In this sense, profiling is a governance practice conducted through computation: it standardizes consumers into system-readable types, then allocates differentiated treatment accordingly (Eke et al., 2019; Kim et al., 2025; Y. Xu et al., 2025).

Two theoretical lenses clarify what is distinctive about contemporary consumer profiling. The first is the idea of the surveillant assemblage, which highlights how profiles are assembled from multiple data flows that were originally produced in different contexts; the consumer becomes a "data double" that can be acted upon across settings (Haggerty & Ericson, 2000). The second is the concept of algorithmic identity, emphasizing that identity categories are increasingly assigned through probabilistic classification rather than self-description (Cheney-Lippold, 2011). Together, these perspectives foreground a key analytical point: profiling is not only about *knowing* consumers but about *making* consumers legible in ways that support systematic sorting and intervention.

This view also explains why profiling creates privacy concerns even without data disclosure. The central mechanism is not necessarily exposure, but consequential classification under opacity and asymmetry (Büchi et al., 2020; King & Forder, 2016). Consumers rarely observe the full profile, the features that shape it, or the counterfactual alternatives ("what would I have seen/paid/received if I were classified differently?"). Profiles can also be sticky: once created, they persist through retention practices and are reinforced by feedback loops (Reed & Forehand, 2016; Trusov et al., 2016). Recommendations influence behavior; behavior updates the profile;

the updated profile further shapes exposure. Profiling thus becomes *recursive*: it does not simply reflect preferences; it can actively participate in producing them.

For the unified framework developed in this paper, profiling can be analytically characterized by a small set of properties that determine its privacy relevance and its potential for harm. Granularity captures how fine the distinctions are (broad segment vs individualized score). Actionability captures whether the profile merely informs content ordering or triggers materially consequential decisions. Portability captures whether profiles travel across services, partners, or contexts through shared identifiers and ecosystem integrations. Stability captures persistence over time and resistance to revision. Contestability captures whether the consumer can understand, challenge, or correct the classification in meaningful ways. Profiling becomes most privacy-invasive when it is granular, highly actionable, portable across contexts, stable over long horizons, and weakly contestable (Mann & Matzner, 2019), conditions that effectively convert consumer data treatment into an infrastructure for continuous sorting.

Consumer profiling should be treated as the bridge between data treatment and privacy impact: it is the point where transformed traces become institutionalized representations and where those representations are operationalized into differentiated treatment (Valletti & Wu, 2020). This conceptualization aligns with the paper's broader argument that privacy is not only threatened by "having data", but by the systematic capacity to classify, predict, and intervene in consumer life through scalable socio-technical systems.

Privacy Harms and Risk Pathways

Privacy harms in AI-enabled consumer analytics cannot be reduced to "data leakage" or unauthorized disclosure. In the context of data treatment and profiling, harm more often arises from systematic visibility, inference, and differential treatment, including situations where the data never leave the firm or are nominally "de-identified" (Custers, 2018; Solove, 2006). Conceptually, the relevant question is not only what information is collected, but how the treatment pipeline and

profiling apparatus convert traces into actionable classifications that shape what consumers can see, pay, or access (Acquisti et al., 2015). This shifts privacy from a narrow informational concern to a governance problem that involves autonomy, fairness, and power asymmetries (Solove, 2006).

A useful theoretical organization distinguishes four families of privacy harms that are tightly coupled to profiling intensity. Informational harms include loss of control over personal information flows, unexpected secondary uses, and the creation of comprehensive consumer "portraits" through linkage and enrichment (Lupton, 2020; Solove, 2006). These harms include re-identification and attribute reconstruction, but also the more ordinary (and pervasive) experience of being tracked across contexts (Acquisti et al., 2015). Autonomy harms arise when profiling is used to steer attention, preferences, and choices: targeting and ranking systems can exploit situational vulnerabilities, produce "choice architectures" optimized for firm objectives, and narrow the informational environment in ways that are difficult to perceive from within (Susser et al., 2019). Distributive and fairness harms occur when profiles become the basis for unequal treatment, exclusion from offers, price steering, differential service quality, or systematically higher friction for certain inferred groups (Barocas & Selbst, 2016; Wachter, 2022). Importantly, these harms do not require explicit use of sensitive categories; they can emerge through proxies and correlated behavioral signals (Barocas & Selbst, 2016). Finally, security harms increase as treatment and profiling intensify: aggregation creates high-value targets, and the compromise of a profile repository can reveal not only what consumers did, but what the system inferred about them (Solove, 2006).

These harms are generated through recurring risk pathways that connect data treatment to profiling outcomes. One pathway is context transposition: traces generated in one context (browsing, mobility, social interaction) are repurposed in another (marketing eligibility, risk scoring, pricing) once they are integrated and made machine-legible, undermining context-appropriate information flows (Solove, 2006). Another pathway is inferential escalation, where seemingly non-sensitive inputs are transformed into sensitive conclusions (e.g., vulnerability, life events, financial stress) and treated as operational truths (Acquisti et al., 2015). A third pathway is function creep in which data and models built

for one purpose become infrastructural assets for additional purposes because marginal reuse is cheap and organizational incentives favor expansion (Solove, 2006). These pathways matter because they produce privacy impacts even under "lawful collection" narratives, precisely because the harm mechanism is transformation and activation, not simply collection (Acquisti et al., 2015).

A distinct pathway concerns opacity and contestability. Profiling systems typically operate under strong informational asymmetry: consumers rarely see the features driving their classification, the uncertainty of the model, or the counterfactual treatment they would have received under a different profile (Wachter, 2022; Wachter et al., 2017). This opacity makes harms difficult to detect and correct, and it can normalize a governance regime where important decisions are made through unobservable ranking and scoring (de Laat, 2018; Vaassen, 2022; Wachter et al., 2017). The result is a privacy problem with institutional characteristics: the individual cannot reasonably manage it through isolated consent decisions, because the relevant processes are continuous, adaptive, and distributed across ecosystems (Acquisti et al., 2015).

Profiling systems introduce feedback loops that can deepen harms over time. Interventions derived from profiles (recommendations, targeting, selective exposure, friction) shape behavior; the resulting behavior becomes new training data; the updated model further stabilizes the profile and intensifies intervention (Susser, 2019; Susser et al., 2019). This recursive dynamic is central to autonomy and fairness harms: systems may gradually narrow a consumer's informational environment, amplify certain behaviors, and lock individuals into trajectories that appear "personalized" but function as a form of soft constraint (Susser et al., 2019; Barocas & Selbst, 2016). For a unified conceptual framework, this means privacy impact should be analyzed not as a one-time event but as an emergent outcome of repeated cycles of: treatment; profiling; intervention; learning.

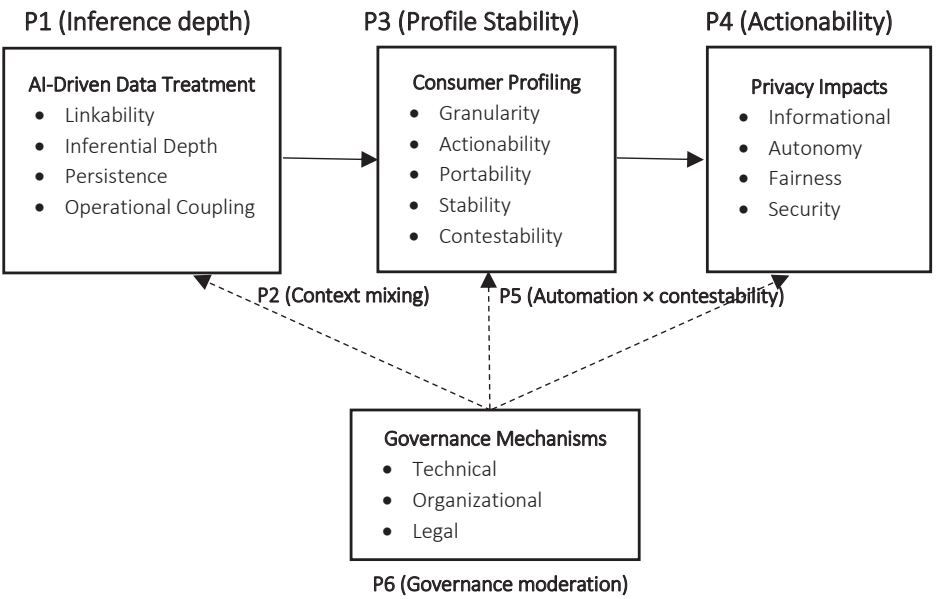
Taken together, these harm families and pathways motivate a shift in what counts as privacy-relevant evaluation. The most consequential risks arise when treatment produces high linkability, high inferential depth, strong persistence, and tight operational coupling between profiles and decisions (Solove, 2006; Wachter et al., 2017). Under these conditions, privacy is no longer primarily about secrecy; it becomes about the legitimacy and accountability of a system

that continuously classifies consumers and makes those classifications consequential (Barocas & Selbst, 2016; Susser et al., 2019).

Toward a Unified Conceptual Framework

A unified account of privacy in AI-enabled consumer analytics becomes possible when the analysis is organized as a causal chain rather than as a checklist of compliance items. The chain links *data treatment* (what the system can observe and infer) to *profiling intensity* (how strongly those inferences govern consumer treatment), to *privacy impact* (what kinds of harms occur and how severe they are), with *governance controls* operating as moderators that can weaken, or unintentionally strengthen, each link.

Figure 1. Unified conceptual framework linking AI-driven data treatment, consumer profiling, governance mechanisms, and privacy impacts



Source: Developed by the Authors.

Figure 1 summarizes the proposed conceptual framework. It illustrates how the structural properties of AI-driven data treatment shape consumer profiling characteristics, which in turn influence the severity and nature of privacy harms, while governance mechanisms moderate these relationships across the entire process.

At the upstream end of the framework, the structural properties of AI-driven data treatment – particularly linkability, inferential depth, persistence, and operational coupling – shape the informational capacity available for consumer profiling (Chierici et al., 2019; Churchill, 2016; Lyon, 2014). These upstream characteristics influence the extent to which consumer profiles become granular, actionable, portable, stable, and contestable, thereby determining the likelihood and severity of downstream privacy harms.

These treatment properties feed into profiling intensity, which describes how forcefully treated data are converted into operational classifications. Profiling intensity is captured by granularity (broad segment vs individual scoring), profile stability (temporal continuity of consumer classifications), automation (degree of human discretion/oversight), and actionability (how tightly profiles drive differential outcomes) (Battaglini & Rasmussen, 2019; Karagiannis et al., 2007). Actionability is the key "severity amplifier": a profile that merely changes content ordering is qualitatively different from a profile that triggers eligibility gating, price steering, or differential service. This is where privacy becomes inseparable from governance because the harms depend on how classification is embedded in decisions and whether those decisions are explainable and contestable.

Downstream, privacy impact can be theorized as "*harm type × severity*". Harm types include informational harms (unexpected secondary use, loss of control, comprehensive portrait-building), autonomy harms (manipulative steering, constrained informational environments), distributive/fairness harms (exclusion, disadvantage, proxy discrimination), and security harms (aggregation and breach amplification) (Mann & Matzner, 2019). Severity increases when impacts are (i) difficult to detect from the consumer's vantage point, (ii) hard to reverse once profiles stabilize, and (iii) consequential for access, price, visibility, or dignity. The framework also anticipates that harms can be systematically unequal even

without explicit sensitive attributes, because profiling often operationalizes proxies that reproduce disparate outcomes (Barocas & Selbst, 2016).

Governance controls operate throughout the chain rather than at a single point. Technical controls (data minimization, privacy-enhancing technologies, access controls, audit logs), organizational controls (purpose limitation in product governance, retention rules, model-risk management, independent review), and legal controls (rights, transparency duties, constraints on profiling and secondary use) can reduce risk, but only when matched to the actual mechanism producing harm. For instance, consent alone is structurally weak against harms produced by inference depth and persistence, whereas contestability and decision transparency are more directly targeted at profiling-driven impacts (Bouchareb, 2026; Wachter et al., 2017). Likewise, limits on cross-context linkage address the context-mixing mechanism emphasized by contextual integrity (Nissenbaum, 2004).

The effectiveness of governance controls should also be interpreted within their cultural and institutional context. While the structural mechanisms of the framework remain constant, consumer expectations regarding privacy, transparency, automated decision-making, and organizational accountability differ across societies. Similarly, regulatory environments vary in the rights they grant individuals, the obligations imposed on organizations, and the enforcement of profiling restrictions. These differences influence how governance mechanisms moderate the relationship between data treatment, profiling intensity, and privacy harms. Effective governance therefore depends not only on technical safeguards but also on transparent organizational practices and accountability mechanisms that foster trust in AI-enabled decision environments (Bouchareb & Moussaoui, 2026). Consequently, the proposed framework is intended to provide a common conceptual structure while allowing its governance dimension to adapt to diverse cultural and regulatory settings.

Testable propositions

The framework yields propositions that can be evaluated across sectors and platform types:

- **P1 (Inference depth).** Greater **inference depth** increases privacy impact even when raw inputs are nominally non-sensitive, because treatment can produce sensitive attributes downstream (Acquisti et al., 2015).
- **P2 (Context mixing).** Greater **linkability** and cross-context integration increases perceived privacy violation and informational harms by disrupting context-appropriate information flows (Nissenbaum, 2004, 2009; Susser et al., 2019).
- **P3 (Stability).** Higher profile **stability** increases autonomy and fairness harms by making historical traces consequential and by stabilizing classifications that are difficult to escape.
- **P4 (Actionability).** The effect of profiling on harm severity is stronger when **actionability** is high (e.g., gating, price steering, differential service) than when profiling is used only for low-stakes personalization.
- **P5 (Automation × contestability).** Higher **automation** increases harm severity when transparency and contestability are weak; strong contestability attenuates this effect (Wachter et al., 2017).
- **P6 (Governance moderation).** Multi-layer governance attenuates the effect of profiling intensity on privacy impact; in the absence of such governance, profiling intensity becomes a primary driver of disparate outcomes (Barocas & Selbst, 2016).

Implications for future research

Three empirical directions follow directly from the framework. First, develop measurement constructs for inference depth, context mixing, profile stability, and actionability that are comparable across firms and sectors (moving beyond "data collected" as the primary metric). Second, test causal pathways using multi-method designs: survey/conjoint experiments for perceived violation under controlled variations of scope/linkability; audit studies and impact assessments to detect differential treatment and proxy-based disparity; and longitudinal designs to capture persistence and feedback loops. Third, evaluate governance as a moderator through comparative and quasi-experimental approaches (policy changes, platform rule shifts, retention-limit interventions) to estimate which

controls meaningfully reduce harm and under what conditions. A fourth direction is to examine the framework across different cultural and institutional environments. Comparative studies could investigate whether consumer perceptions of profiling intensity, privacy harms, transparency, and contestability differ across countries with distinct privacy norms and regulatory traditions. Such research would help determine which elements of the framework are universal and which are shaped by local cultural expectations and governance practices.

Conclusion

AI-enabled consumer analytics has shifted the privacy problem from isolated moments of disclosure to an integrated regime of data treatment, profiling, and intervention. Privacy is increasingly shaped not by whether data are collected in the first place, but by how traces are transformed, linked, abstracted, and converted into profiles that govern what consumers see, pay, and can access. This paper argues that the core analytical challenge is therefore structural: privacy outcomes emerge from a chain that begins with upstream treatment practices (scope, linkability, inference depth), intensifies through downstream profiling properties (granularity, profile stability, automation, actionability), and materializes as heterogeneous harms whose severity depends on opacity, contestability, and the consequential nature of differential treatment.

By synthesizing these elements into a unified conceptual framework, the paper contributes a parsimonious vocabulary for describing why privacy risks can remain high even under familiar compliance narratives. In particular, the framework highlights three dynamics that are often underestimated in fragmented debates. First, inference is a privacy event: systems can produce sensitive attributes from non-sensitive inputs and operationalize them without explicit disclosure. Second, context mixing is a risk mechanism: cross-domain linkage transforms socially situated information into portable assets that undermine reasonable expectations of contextual integrity. Third, profiling becomes consequential through actionability and stability: when profiles are durable and

tightly coupled to decisions, privacy harms extend beyond informational control to autonomy, fairness, and security.

The framework also clarifies practical implications for governance. Effective privacy protection cannot be reduced to transparency statements or individual choice mechanisms; it requires controls that are proportionate to the mechanisms producing harm. Firms should treat inference depth and profile actionability as first-order risk variables, not as technical details, and should build constraints on persistence, cross-context linkage, and secondary use into product and model governance. Regulators should prioritize enforceable requirements that strengthen transparency and contestability for consequential profiling, while limiting high-risk combinations of linkability, persistence, and actionability. For researchers, the framework identifies profiling intensity as a key mediating construct that connects upstream data practices to downstream impacts and thus helps structure empirical work across disciplines.

Limitations. As a theoretical contribution, the framework necessarily abstracts from sector-specific institutional constraints and heterogeneous data environments. Risk mechanisms and appropriate controls may vary across domains such as advertising, retail, finance, health-adjacent consumer apps, and public services, where stakes, incentives, and regulatory baselines differ. In addition, privacy expectations are not culturally invariant: cross-cultural norms about sensitivity, acceptability of profiling, and trust in institutions can shape both perceived violation and the legitimacy of governance interventions. These considerations caution against treating the framework as a one-size-fits-all diagnostic and motivate comparative studies that adapt constructs to sectoral contexts and diverse normative settings.

The paper's propositions translate the framework into an empirical program: they invite future research to measure inference depth and context mixing, to test how profile stability and actionability amplify autonomy and fairness harms, and to evaluate which governance interventions measurably reduce impact across sectors and platform ecosystems. As AI systems increasingly mediate consumer life, the fundamental privacy question becomes one of legitimacy: under what conditions is it acceptable for organizations to continuously infer,

classify, and intervene, and what institutional safeguards are necessary to ensure that consumer understanding does not quietly become consumer control.

Declaration of competing interest

The author(s) declare no competing interests.

Declaration Of Generative AI and AI-Assisted Technologies In The Writing Process

During the preparation of this work, the authors used an LLMs tool in order to improve the language and readability of the article. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

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Luísa Alexandra Antunes Ferreira
University of Trás-os-Montes and Alto Douro, Portugal
al2024116451@alunos.utad.pt

Rui Silva
University of Trás-os-Montes e Alto Douro
Centre for Transdisciplinary Development Studies (CETRAD) and NECE - Research Centre for Business Sciences, Portugal
ruisilva@utad.pt

Cidália Pereira de Oliveira
Economics Management and Information Technologies, REMIT – Research on Economics Management and Information Technologies, Portugal
cidalia.o@hotmail.com

Francisco Carreira
Polytechnic University of Setúbal, Portugal
Research Centre on Accounting and Taxation (CICF), Portugal
francisco.carreira@esce.ips.pt

Margarida Rodrigues
Cefage-Ubi, Covilhã, Portugal
mmmrodrigues@sapo.pt

ERP Systems and Cost Control in the Construction Industry: A Conceptual Analysis of Material Flow Management

Abstract

Objective: Effective stock management and material flow control are essential for optimizing inventory levels and improving project performance in the construction sector, where decentralised job sites, variable material consumption, fragmented supply chains and strict budget constraints create distinctive operational challenges. Inadequate visibility of material flows often results in waste, emergency procurement, cost overruns and project delays. This paper examines how integrated management practices, supported by Enterprise Resource Planning (ERP) systems and complementary digital technologies such as Building Information Modeling (BIM), can enhance cost control, budget monitoring and visibility across material flows.

Methodology: Using a qualitative, exploratory, and descriptive approach, the study conducts a narrative/conceptual review of the literature with thematic content analysis and compares construction practices with those of more standardized sectors, such as retail and manufacturing.

Findings: The analysis highlights the specific inventory and logistics challenges faced by construction organisations and explores how digital integration can support more effective decision-making and resource coordination. Based on the findings, a conceptual framework is proposed linking ERP–BIM integration, material flow visibility, operational performance and cost control outcomes.

Value Added: The study contributes to the literature by synthesizing fragmented knowledge on construction logistics, inventory management and digital technologies into a unified conceptual perspective. From a managerial standpoint, the findings emphasise the importance of investing in integrated digital systems and real-time information sharing to improve inventory accuracy, reduce material losses and strengthen budget governance.

Recommendations: The paper also identifies opportunities for future empirical research, particularly through quantitative studies and multiple case analyses assessing the impact of digital integration on construction project performance.

Key words: inventory management, cost avoidance, cost control, budget control, construction logistics, ERP, BIM

JEL codes: M11, M41, O33, L74

Introduction

Inventory management has become a strategic organisational function, playing a central role in balancing supply and demand, controlling costs and increasing operational efficiency. In a highly competitive and dynamic environment, effective inventory management is crucial to business sustainability and profitability. However, the challenges associated with inventory management vary significantly across industries and are particularly critical in the construction sector.

Construction presents unique operational characteristics that hinder the application of traditional inventory control models. Projects are decentralised, raw material prices are volatile, deadlines are strict and construction processes are highly customized. These features make material management more complex and error-prone. Ineffective inventory control may lead to waste, delays, unnecessary expenditures and even project interruptions.

In contrast, sectors such as retail and manufacturing operate with more predictable demand patterns and continuous production flows, allowing for more structured planning. While these sectors also face logistical challenges, their centralised and stable environments facilitate greater automation and the use of advanced tracking technologies.

This study aims to examine how ERP and BIM integration can improve material flow visibility and cost control in the construction sector.

Based on these considerations, the following research questions were formulated:

RQ1: *What inventory and material flow challenges distinguish construction from more standardized sectors?*

RQ2: *How can ERP and BIM integration improve material flow visibility and cost control?*

RQ3: *What managerial implications emerge from the adoption of integrated digital systems in construction projects?*

The relevance of this topic lies in the growing need for construction companies to adopt modern and integrated material control practices, not only to reduce waste but also to reinforce competitiveness and project sustainability. This research provides a critical reflection on how material logistics can evolve through technological tools and management models adapted to the sector's specificities.

Theoretical Framework

Fundamental Concepts of Inventory and Logistics

Inventory management is a core element of business logistics, ensuring a balance between product availability and storage costs. According to Ballou (2006), inventory acts as a buffer between different stages of production and distribution

within the supply chain. Effective management reduces losses, minimizes operational costs and ensures process continuity.

Inventory categories include raw materials, work-in-progress items and finished goods. Management requires decisions regarding order quantities, replenishment schedules and control models such as Just-in-Time (JIT), reorder points and continuous replenishment systems (Slack et al., 2015). Digital technologies are crucial to mitigate supply chain fragmentation (Papadonikolaki & Wamelink, 2017). In sectors with predictable demand – like retail – these models are especially efficient.

However, the construction sector faces distinct challenges due to the dynamic and variable nature of its activities. Projects are executed in temporary, site-based environments with unique physical, organisational and operational conditions, making standardisation difficult and increasing uncertainty and variability in project execution (Ballard & Howell, 2003). A major challenge in construction logistics is the decentralised storage of materials. Deliveries are typically made directly to construction sites, where storage space is often limited and site conditions may expose materials to damage, deterioration or theft. Delays in deliveries or unexpected variations in material consumption can disrupt project schedules, resulting in emergency procurement and increased project costs (Johnston, 2016).

Recent studies emphasise the importance of integrating technologies such as Building Information Modeling (BIM) and Enterprise Resource Planning (ERP) to improve inventory visibility, accuracy and decision-making (Luz et al., 2020).

Budget Control and Material Flow

Target Costing Management (TCM) aligns cost planning with organisational strategy and market expectations (Cooper & Slagmulder, 1999). It emphasizes early-stage decision-making during product development, where the majority of life-cycle costs are defined (Yasukata et al., 2013). Functional analysis plays a pivotal role in enhancing competitive advantage (Mouritsen et al., 2001). TCM requires cross-functional collaboration involving planning, engineering, procurement, finance and production teams. Designers rely on accurate information regarding

customer needs, material availability and production capabilities (Ansari & Bell, 1997). Perčević et al. (2015) highlight eight key characteristics of TCM: market-based target prices, strategic profit margins, early cost definition, cost decomposition, cross-functional teamwork, detailed cost data, systematic cost comparison and strict adherence to target cost limits. Contingency theory explains variations in TCM adoption across non-Japanese firms, as management practices must be adapted to contextual conditions (Carr & Ng, 1995; Drury, 2006).

Value Stream Mapping (VSM), proposed by Rother and Shook (2003), provides a visual representation of material and information flows across processes. It distinguishes value-adding from non-value-adding activities, supporting waste reduction and continuous improvement. Once the strategic direction is set, implementation is carried out by cross-functional teams. This stage is pivotal and should include professionals from diverse areas such as planning, marketing, engineering, finance, procurement and production. For instance, product designers require comprehensive information on customer preferences, manufacturing capabilities and material availability. Based on these data, they determine both the type of product to be developed and how it will be produced (Ansari & Bell, 1997; Yasukata et al., 2013).

Research on non-Japanese firms reveals some variations in how TCM is applied (Carr & Ng, 1995; Ellram, 2006; Talha & Raja, 2010). According to contingency theory, such differences are to be expected, as any new management accounting system must be tailored to fit the specific context in which it is implemented (Carenzo & Turolla, 2010; Drury, 2006). According to Rother and Shook (2003), the Value Stream Mapping (VSM) methodology involves creating a visual map of the production system that distinguishes between activities that add value and those that do not. This tool is used to analyse and improve production flows by highlighting inefficiencies. To develop a VSM, Rother and Shook (2003) propose the following steps:

Since VSM does not encompass all product families, the first step is to select the specific product family to be analysed. Typically, the one most critical to the company is chosen first.

The current state map is then created using standard symbols and key performance indicators such as cycle time, setup time, lead time, shift availability,

workforce allocation per process, number of shifts, batch size and average inventory between processes. This step helps identify bottlenecks, major sources of waste and existing value streams across the supply chain. Based on the analysis of the current state, a future state map is designed. This version integrates improvements focused on eliminating waste and enhancing value creation. The same indicators are applied, but this time with a focus on optimised processes and improved flow. Finally, an action plan is developed to implement the proposed improvements, often using Lean tools and techniques to guide the changes.

Digital Technologies in Construction: BIM, RFID, IoT and Emerging Smart Systems

The digital transformation of the construction sector has profoundly reshaped operational efficiency, safety performance, and supply chain sustainability. Among the most influential technologies are Building Information Modeling (BIM), Radio Frequency Identification (RFID) and the Internet of Things (IoT), which together form the technological backbone of smart construction ecosystems. When combined, these tools improve real-time visibility, reduce uncertainties and enhance coordination across project stakeholders.

Integration of BIM with RFID has demonstrated significant potential for real-time tracking of materials, prefabricated elements and equipment throughout their lifecycle. BIM–RFID coupling can reduce material search time and improve prefabrication assembly accuracy (Brandín & Abrishami, 2024; Costin et al., 2015). This integration enhances transparency across the supply chain and supports just-in-time deliveries in modular and off-site construction.

RFID technologies have also been widely recognized for their contribution to safety and workforce monitoring. According to Li et al. (2018), RFID-enabled safety systems enable continuous monitoring of worker proximity to hazardous zones, significantly reducing accident risk and enabling proactive safety interventions.

IoT sensors further expand the capabilities of construction logistics by enabling predictive maintenance, environmental monitoring and dynamic control

of material flows. IoT-based solutions have improved equipment utilisation and reduced unplanned downtime in large-scale construction projects (Wan & Bai, 2020). Embedded sensors support automated data capture on material consumption and site conditions, enabling more accurate forecasting and waste minimization.

Integrated Project Delivery (IPD) models reinforce these technological advancements by promoting collaboration, real-time communication, and shared accountability among stakeholders. Studies show that IPD combined with digital platforms improves decision-making efficiency and reduces cost deviations (Qiao, 2023; Kent & Becerik-Gerber, 2019).

Methodology

This study employs a narrative/conceptual literature review based on a qualitative, exploratory and descriptive conceptual research design to analyse inventory management practices in the Portuguese construction sector and compare them with those of the retail and manufacturing industries. A qualitative methodology was selected to capture the specificities, challenges and practices based on non-quantifiable data (Creswell & Poth, 2018).

Data collection was carried out through an extensive literature and document review involving scientific articles, sectoral reports, books and publications from official organisations. Priority was given to studies focused on inventory management, logistics and digital technologies in the analysed sectors. Most sources were published within the last decade and selected primarily from Scopus and Web of Science, ensuring up-to-date and contextually relevant information.

Additionally, industry reports and sectoral publications from construction, retail and manufacturing organisations were examined to identify concrete practices, challenges and adopted inventory control solutions (Yin, 2015).

Data analysis followed Bardin's (2011) content analysis methodology, categorizing information into four thematic dimensions: (1) inventory management

characteristics, (2) sector-specific challenges, (3) technological applications and (4) cross-sector comparisons. This enabled the development of a comparative framework and the identification of the main factors influencing logistics performance in each sector.

The main limitation of the study is the absence of primary data collection, such as interviews or surveys with sector professionals. This limitation results from time constraints and restricted access to field data. Future studies are encouraged to employ empirical approaches to deepen the analysis (Bryman, 2016).

Analytical Framework

Following Jabareen (2009), a conceptual framework was developed to synthesise the relationships identified in the literature and to explain how ERP and BIM integration contributes to material flow visibility and, ultimately, to cost control in construction projects. Previous studies indicate that digital integration and information sharing improve coordination across construction supply chains (Papadonikolaki & Wamelink, 2017), supporting the development of the conceptual framework proposed in this study.

Figure 1. Proposed conceptual framework linking construction-specific challenges, ERP–BIM integration, material flow visibility and cost control outcomes

Construction Challenges	Digital Integration	Information Visibility	Coordination	Operational Performance	Cost Performance
fragmented supply chain	ERP	real-time inventory	collaboration	less waste	cost control
decentralised sites	BIM	material tracking	planning	fewer delays	budget control
inventory uncertainty	RFID/IoT	traceability	procurement	logistics efficiency	profitability

Source: Adapted from the literature on conceptual framework development and BIM-enabled supply chain integration (Jabareen, 2009; Papadonikolaki & Wamelink, 2017).

The framework suggests that the operational characteristics of the construction sector create a need for greater material flow visibility. ERP and BIM integration act as enabling mechanisms that improve information quality, coordination and inventory control, leading to operational improvements and enhanced cost and budget performance.

Specific Challenges in the Construction Sector

Inventory management in the construction sector is inherently complex due to the transient, decentralised and project-based nature of construction operations. In Portugal, these challenges are reinforced by fragmented supply chains, limited integration among project participants and relatively low levels of supply chain management maturity, which hinder the adoption of standardized logistics processes and digital management practices (Arantes et al., 2015).

Although digital technologies have the potential to mitigate supply chain fragmentation, their adoption in construction remains uneven. Unlike manufacturing or retail – where supply chains are integrated, automated and data-driven – the construction sector relies heavily on reactive, loosely coordinated networks. Supplier relationships are typically short-term and project-specific, resulting in reduced visibility of material availability, longer lead times and inconsistent delivery performance (Brandín & Abrishami, 2024). International research confirms that fragmented subcontracting structures significantly increase uncertainties and logistics risks (Chowdhury, 2025).

In Portugal, dependence on small local subcontractors without interoperable information systems further aggravates data fragmentation and operational inefficiencies. Despite European Union initiatives promoting digitalisation, many Portuguese firms still lag behind in adopting BIM, ERP, RFID or IoT-based inventory management tools (Siagian & Jie, 2021). Barriers include high implementation costs, low digital literacy and organisational resistance to process change.

Material losses remain a persistent challenge in construction projects due to inefficient inventory control, inadequate storage conditions, poor handling practices and fragmented coordination among project participants. These inefficiencies reduce project profitability and increase environmental impacts through unnecessary material waste and inefficient resource use (Formoso et al., 2002; Poon et al., 2004). Although environmental regulations have become more stringent, the lack of traceability and standardised inventory management procedures continues to hinder systematic waste reduction and resource optimisation. Overall, the challenges faced by the construction sector arise from the combined effects of operational complexity, fragmented supply chains, technological limitations and organisational inertia, reinforcing the need for integrated digital systems and structured logistics strategies.

As highlighted by Ferreira (2021) in "Development of an Inventory Management Policy at Wurth Portugal", an effective policy can transform resource management into a competitive advantage when supported by robust data and digital processes.

Enterprise Resource Planning (ERP) systems enable data integration across various company departments, allowing real-time stock movement tracking and automated replenishment management (Luz et al., 2020). ERP systems assure real-time cost and inventory visibility, particularly in complex and decentralised environments (Haddara & Elragal, 2015). A modern ERP system should include modules for financial management, logistics, inventory control, order processing, warehouse management and material tracking. Additional modules often include production management, CRM and human resources.

In Portugal, platforms like Primavera Construction and SAP Business One for Engineering have been adopted, mainly by larger firms. However, implementation costs, required process reengineering and training complexity remain major obstacles for micro and small enterprises.

Developing collaborative relationships with suppliers and subcontractors improves delivery coordination, reduces uncertainty and facilitates logistics planning by strengthening information sharing and supply chain integration (Papadonikolaki & Wamelink, 2017). Building Information Modeling (BIM) enables 3D simulation of construction projects, integrating structural, financial and logistical

data. This technology is key for accurate material planning and waste prevention (Brandín & Abrishami, 2024). In Portugal, BIM adoption has been encouraged by public procurement requirements. It serves as a collaborative digital platform that consolidates detailed information on geometry, materials, technical properties and construction processes. It operates as a real-time, shared database updated by all project stakeholders, supporting efficient coordination and early conflict detection (Eastman et al., 2011).

BIM offers proven benefits such as enhanced communication among multidisciplinary teams, improved schedule and cost control, higher project quality and increased sustainability and energy efficiency through integrated environmental performance analysis (Azhar, 2011; Brandín & Abrishami, 2024). It also facilitates building maintenance and operations.

Organisational culture is widely acknowledged as a critical element in management theory and practice, becoming a core component of strategic discourse (Flamholtz, 2001).Zago (2000) identified several key components of organisational culture, including values, beliefs, knowledge, cognition, assumptions, meanings and suppositions.

Numerous factors influence the development and manifestation of organisational culture, such as the company's history, product offerings, market dynamics, adopted technologies, strategic orientation, workforce profile, managerial style and even broader national culture (Needle, 2010). Gramsci & Sader (1990) further suggest that, because culture is embedded in everyday language and routine practices, it can constrain individuals' ability to conceive of alternatives to prevailing norms and assumptions.

Beyond organisational culture, national cultural characteristics also influence the implementation and effective use of ERP and BIM technologies in construction projects. According to Hofstede (2001), cultural dimensions such as uncertainty avoidance, power distance and long-term orientation shape organisational attitudes towards innovation, standardisation and technological change. In construction projects, these cultural characteristics may influence the willingness of organisations to adopt integrated digital platforms such as ERP and BIM, particularly where implementation requires collaborative workflows and information sharing across multiple stakeholders. Organisational

culture and strategic capabilities are significant predictors of BIM adoption, highlighting the importance of leadership commitment, innovation-oriented values and digital collaboration practices (Zakariyyah et al., 2021). Consequently, successful ERP–BIM implementation depends not only on technological capabilities but also on organisational and cultural conditions that facilitate digital transformation.

Conclusion

This study proposed a conceptual framework explaining how the integration of Enterprise Resource Planning (ERP) systems and Building Information Modeling (BIM) enhances material flow visibility and supports cost control and budget performance in construction projects. By addressing the distinctive characteristics of the construction sector – namely its decentralised operations, project-based structure and fragmented supply chains – the study contributes to a better understanding of the limitations of traditional inventory management approaches in this context.

Inadequate visibility of material flows, limited digital integration and weak coordination among supply chain actors are major contributors to material losses, budget overruns, procurement inefficiencies and project delays. In contrast, the integration of ERP and BIM enables greater transparency, real-time information sharing and improved coordination across project stakeholders. ERP systems provide centralised control over decentralised operations, while BIM supports more accurate planning, forecasting and resource allocation. Together, these technologies strengthen decision-making processes and contribute to improved financial and operational performance.

From a theoretical perspective, this research contributes by synthesizing fragmented literature on construction logistics, inventory management and digital technologies into a unified conceptual framework linking ERP–BIM integration, material flow visibility and cost control outcomes. From a managerial perspective, the findings highlight the importance of investing in integrated digital solutions

and fostering data-driven coordination practices to improve inventory control and budget governance across construction projects.

Addressing the Research Question 1, the literature shows that construction differs from manufacturing and retail because of decentralised job sites, fragmented supply chains, project-based production and high demand uncertainty, making inventory management considerably more complex. Related to Research Question 2, the review indicates that ERP–BIM integration improves inventory visibility, real-time information sharing, procurement planning and coordination among stakeholders, contributing to better material flow control and cost performance. Concerning Research Question 3, the analysis suggests that managers should invest in integrated digital platforms, organisational training, supplier collaboration and standardised information management practices to maximize the benefits of digital transformation.

These findings also suggest that successful digital transformation in construction depends not only on technological integration but also on organisational and cultural readiness to support collaborative practices and information sharing.

Research limitations

Related to its conceptual nature and reliance on secondary data sources. As no primary empirical evidence was collected, the proposed framework should be considered exploratory.

Future research

For further outcomes it would be interesting to analyse the relationships identified in this study through surveys, interviews, longitudinal analyses and multiple case-study designs.

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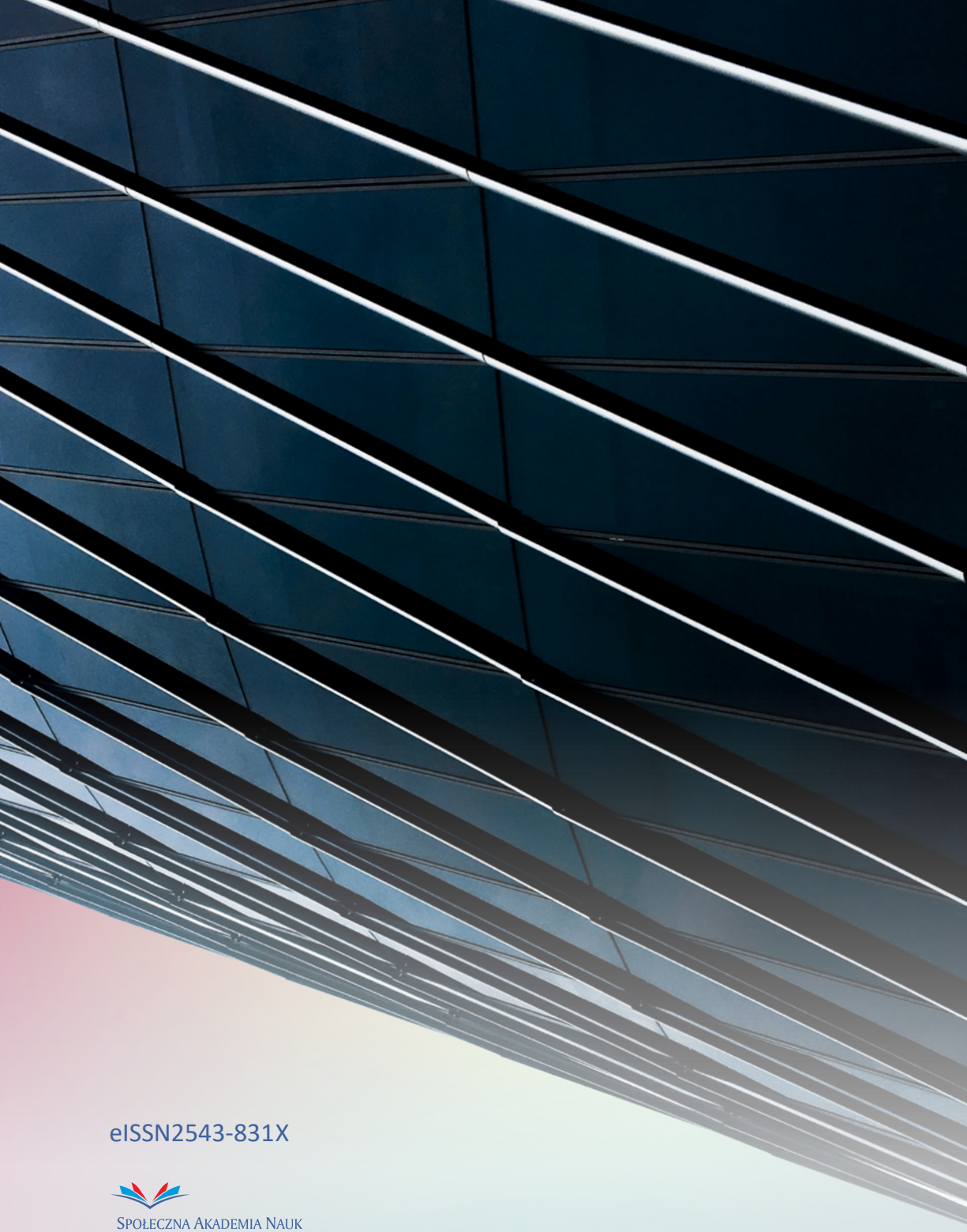

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