

MANAGEMENT ACCOUNTING AND DIGITAL TRANSFORMATION IN THE BAKERY INDUSTRY: OPPORTUNITIES AND CHALLENGES OF ARTIFICIAL INTELLIGENCE

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Abstract

Digital transformation is increasingly changing the way organisations collect, process and use information for managerial decision-making. Within management accounting, the development of artificial intelligence (AI), machine learning, predictive analytics and generative AI creates opportunities to automate routine activities, improve information processing and support forecasting and decision-making. These developments are particularly relevant for the bakery industry, where managerial decisions are influenced by demand variability, raw material costs, production capacity, inventory levels, product perishability and food waste.

The purpose of this paper is to examine the opportunities and challenges associated with the integration of artificial intelligence into management accounting in the bakery industry and to identify the organisational conditions that may influence the effectiveness of AI adoption. The study adopts a thematic literature review methodology, combining recent peer-reviewed research on AI and management accounting with studies concerning digital transformation in the bakery sector and evidence from international institutions. The analysis is organised around five major themes: AI and the transformation of management accounting; AI, information quality and managerial decision-making; AI applications in the bakery industry; data quality and digital competencies; and ethical, organisational and professional challenges.

Based on the literature, two research hypotheses are formulated. The first examines the relationship between AI adoption and the quality and timeliness of management accounting information. The second addresses the moderating role of data quality and digital competencies in the relationship between AI adoption and management accounting effectiveness. A structured questionnaire is proposed for the subsequent empirical validation of the hypotheses.

The literature indicates that AI has the potential to strengthen forecasting, cost analysis, inventory management and decision support. However, the benefits of AI adoption are not independent of data quality, organisational readiness, employee competencies and appropriate human oversight. The paper contributes to the emerging literature by connecting AI and management accounting with the operational characteristics of the bakery industry and by proposing an empirically testable framework for future research.

Keywords: management accounting; artificial intelligence; digital transformation; bakery industry;

Clasificare JEL : M40, M41

1. Introduction and context of the study

Digital transformation has become an important factor in the evolution of accounting and management control. Digital technologies affect not only the infrastructure used by organisations, but also management accounting practices, control systems and the role of management accountants (Möller et al., 2020). The transformation is particularly relevant as organisations increasingly combine accounting information with operational, commercial and customer-related data.

The emergence of artificial intelligence adds a new dimension to this transformation. Unlike traditional information systems, AI-based technologies can process large volumes of structured and unstructured information, identify patterns and generate predictions or recommendations. Recent

research indicates that AI, machine learning, deep learning, explainable AI, generative AI and large language models are increasingly discussed in relation to management accounting and the future role of accountants (Abbas, 2026). A recent systematic review analysed 91 studies and identified digitalisation, AI technologies, organisational transformation, and future roles and competencies as interconnected areas of research.

The implications are relevant for management accounting because the function has traditionally been concerned with providing information for planning, control and decision-making. Digital technologies may change both the speed at which information becomes available and the type of information that can be incorporated into managerial analysis. Möller et al. (2020) argue that digitalisation has the potential to disrupt management accounting and the role of the controller, while Andreassen (2020) provides empirical evidence that digital technologies can alter the work and responsibilities of management accountants.

The bakery industry provides a particularly relevant setting for examining these developments. Bakery production is characterised by demand fluctuations, product perishability, inventory requirements, production scheduling and the need to manage food waste. These characteristics create a strong dependence on timely operational information.

Recent research specifically addressing the bakery sector shows that Industry 4.0 technologies can support production efficiency, real-time monitoring, traceability, inventory management, forecasting and waste reduction (Melesse & Orrù, 2025).

The relevance of AI for bakery operations is illustrated by Hübner et al. (2024), who examined a machine-learning-based demand forecasting system using real-world bakery data. In their case study, the system was associated with an average 30% reduction in bakery returns in 2022. This result should not be interpreted as a general estimate of the effect of AI across the bakery industry; it represents the outcome of a specific case and methodology.

The connection between digitalisation and management accounting becomes apparent when operational data are incorporated into financial and managerial analysis. Sales forecasts can influence production planning. Production data can influence cost analysis. Inventory information can influence purchasing decisions. Waste data can affect product profitability. Consequently, the digitalisation of production and sales processes can also change the information environment in which management accounting operates.

The broader adoption of AI also depends on organisational capabilities. OECD (2025) identifies connectivity, AI-enabling data and computing resources, skills and finance as important conditions for AI adoption among SMEs. The report also emphasises that AI adoption remains lower among SMEs than among large firms.

The European context illustrates the importance of this issue. Eurostat reports that in 2025, 20.0% of EU enterprises with at least 10 employees used AI technologies, compared with 13.5% in 2024. Romania recorded 5.2%, placing it considerably below the EU average.

This context is relevant for accounting professionals as well. Cordos and Tiron-Tudor (2023) show, through a thematic review of professional accounting bodies, that the accounting skill set increasingly includes digital competencies alongside traditional technical and soft skills. Their analysis identifies AI, data analytics, advanced IT, databases and programming among the digital competencies relevant to the accounting profession.

The research problem addressed in this paper therefore concerns the relationship between AI adoption and the effectiveness of management accounting in bakery enterprises, while considering the importance of information quality, data quality and digital competencies.

The objective of the study is to identify the main opportunities and challenges associated with AI adoption in management accounting in the bakery industry and to develop a conceptual framework that can subsequently be tested empirically.

Two research hypotheses are formulated:

H1: AI adoption is positively associated with the quality and timeliness of management accounting information in bakery enterprises.

H2: Data quality and digital competencies positively moderate the relationship between AI adoption and management accounting effectiveness in bakery enterprises.

2. Theoretical background and literature review

Digital transformation and management accounting

Management accounting provides information intended to support planning, control and decision-making. Traditionally, much of this information has been generated through periodic reporting processes based on historical financial and operational data. Digital transformation changes this environment by increasing the volume, speed and diversity of information available to managers.

Möller et al. (2020) describe digitalisation as a development capable of affecting management accounting and control practices as well as the role of the controller. The authors highlight the need to understand how emerging technologies influence the management accounting domain rather than considering digitalisation as a simple automation of existing processes.

Andreassen (2020) similarly demonstrates that digital technology can alter management accountants' roles. The increasing availability of digital information creates opportunities for accountants to become more involved in analysis and decision-making support, rather than focusing predominantly on routine information processing.

This transformation is important for the bakery industry because accounting information can increasingly be connected to operational information. Traditional cost accounting may provide information about the cost of ingredients, labour and production. A digitally integrated system can additionally incorporate information about sales patterns, production volumes, inventory levels and waste. The result is a broader information environment in which management accounting can contribute to operational decisions in closer to real time.

Artificial intelligence in management accounting

Artificial intelligence represents a further stage of digital transformation. AI can support activities involving classification, prediction, pattern recognition and automated information processing. Within management accounting, these capabilities can potentially be used for forecasting, anomaly detection, cost analysis and decision support.

Abbas (2026) provides one of the most recent comprehensive reviews of this field. The study analyses 91 articles concerning digitalisation, AI, machine learning, deep learning, explainable AI, generative AI and large language models in management accounting. The review concludes that these technologies can transform accounting information and organisational structures, while also creating challenges related to data privacy, confidentiality, security, ethics and professional competencies.

The implications for management accountants extend beyond technical skills. AI may alter the distribution of tasks between humans and technology. Leitner-Hanetseder et al. (2021) examined actors, tasks and roles in AI-based accounting using a Delphi study and expert workshops. Their research suggests that the future of accounting is likely to involve different forms of interaction between humans and AI-based technologies rather than a simple replacement of human professionals.

Yigitbasioglu et al. (2023) also shows that digital transformation affects accountants' advisory roles. Their study, based on interviews with professionals in Australian professional services firms and representatives of accounting bodies, emphasises the importance of combining digital human capital with generic and social capabilities. Thus, AI adoption in management accounting should be understood as a socio-technical transformation. Technology is one component, but its effectiveness also depends on people, processes and organisational capabilities.

3. Thematic literature review methodology

Research design

The study adopts a thematic literature review methodology. The choice of this approach reflects the objective of the paper. The purpose is not merely to count publications concerning AI and accounting, but to identify recurring concepts, relationships and challenges across different streams of literature.

The methodological logic is consistent with the concept-centric approach recommended by Webster and Watson (2002), according to which literature reviews should organise existing knowledge around concepts and identify areas requiring further research.

Thematic analysis is also appropriate because it allows recurring patterns to be identified across heterogeneous sources. Braun and Clarke (2006) describe thematic analysis as a flexible method for identifying and reporting patterns within qualitative material.

The methodology was developed in five stages:

1. definition of the research questions;
2. identification of relevant academic and institutional sources;
3. screening and verification of sources;
4. thematic coding and categorisation;
5. synthesis of findings and development of the conceptual framework.

The methodological structure also follows the logic of the uploaded reference article, which uses thematic literature review to identify recurring categories and subsequently validates those categories against professional accounting frameworks.

Research questions

The thematic review was guided by five research questions:

RQ1. How does artificial intelligence influence management accounting processes?

RQ2. What opportunities associated with AI adoption are identified in management accounting research?

RQ3. What organisational, technological and professional challenges constrain AI adoption?

RQ4. Which AI applications are particularly relevant to the bakery industry?

RQ5. What organisational conditions may influence the relationship between AI adoption and management accounting effectiveness?

Search strategy

The documentation process prioritised peer-reviewed academic publications, official institutional publications, legislation and official statistical data. The substantive literature search focused primarily on the period **2019–2026**, reflecting the rapid development of AI-related research. Earlier publications were retained when they provided methodological foundations or important conceptual contributions.

The following keyword combinations were used:

- “artificial intelligence” AND “management accounting”;
- “AI” AND “management accountant”;
- “artificial intelligence” AND accounting AND “decision making”;
- “digitalization” AND “management accounting”;
- “machine learning” AND bakery AND forecasting;
- “AI” AND bakery;
- “Industry 4.0” AND bakery;
- “digital transformation” AND bakery;
- “AI adoption” AND SMEs;
- “data quality” AND AI adoption;

- “digital competencies” AND accounting.

The search was supplemented through backward reference checking of highly relevant studies. For source verification, publisher pages, DOI records, official institutional websites and indexed bibliographic records were checked. The study does not claim to represent an exhaustive numerical search of Scopus or Web of Science. Instead, it prioritises verifiable sources that could be independently checked through authoritative publication or institutional records.

Inclusion and exclusion criteria

Sources were included when they met at least one of the following conditions:

- they were peer-reviewed academic publications;
- they were systematic or thematic literature reviews;
- they presented empirical evidence relevant to AI, management accounting or digital transformation;
- they addressed the bakery or food-production context;
- they were published by official institutions such as OECD, Eurostat or IFAC;
- they constituted relevant European legislation.

Sources were excluded when they:

- were commercial promotional materials;
- were blogs or unverified web publications;
- lacked identifiable authorship;
- contained claims that could not be independently verified;
- duplicated information already available from a primary source;
- addressed AI without a meaningful relationship to the research questions.

Thematic coding framework

The selected literature was coded according to the following analytical structure:

Tabel 1: Analytical structure

Main theme	Main dimensions
AI and management accounting	automation, predictive analytics, AI-supported analysis
Information quality	accuracy, timeliness, relevance, integration
Managerial decision-making	planning, forecasting, budgeting, control
Bakery applications	demand forecasting, inventory, production, waste
Data quality	availability, accuracy, integration, governance
Digital competencies	data analytics, AI literacy, IT skills
Organisational readiness	infrastructure, finance, management support
Risks and ethics	privacy, security, transparency, accountability
Professional transformation	reskilling, upskilling, human–AI collaboration

Source Author`s own structure

The categories were not established solely on theoretical grounds. They emerged from the convergence of the reviewed literature. For example, Abbas (2026) identifies AI technologies, organisational transformation and future accounting competencies as major areas in management accounting research. Similarly, the bakery literature emphasises production efficiency, real-time monitoring, inventory optimisation, forecasting and waste reduction (Melesse & Orrù, 2025).

4. Results of the thematic analysis *The thematic analysis resulted in five major themes:*

Theme 1: AI and the transformation of management accounting

The first theme concerns the changing nature of management accounting. Literature suggests that digitalisation is moving management accounting away from purely retrospective information processing. Digital systems enable information to be collected and processed more rapidly and allow financial data to be combined with operational information.

Möller et al. (2020) identify digitalisation as a factor capable of changing management accounting and control practices, as well as the role of controllers. Andreassen (2020) provides further evidence that digital technologies influence the role of management accountants. The availability of digital information can create opportunities for greater involvement in analytical and advisory activities.

The role transformation is particularly relevant when AI is introduced. Abbas (2026) identifies automation of basic accounting tasks and changes in accountants' roles and skills among the main consequences discussed in the literature. The emerging picture is therefore not one of the disappearances of management accounting.

Rather, the function is being reconfigured. The accountant's contribution increasingly depends on the ability to interpret information, assess its relevance and communicate its implications to management.

Theme 2: AI, information quality and managerial decision-making

The second theme concerns the relationship between digital systems, information quality and decision-making. This relationship has strong empirical support in the management accounting literature.

Ratmono et al. (2023) examined 536 urban SMEs in Indonesia using questionnaire data. Their study found that digitalisation in management accounting systems had positive effects on the accuracy and timeliness of accounting information and on cost reduction. Accuracy, timeliness and cost reduction subsequently contributed to management decision-making effectiveness.

This finding is important for the present research because it suggests that technology does not necessarily improve decision-making directly. The effect can operate through the quality of the information available to management.

This distinction is incorporated into the conceptual model proposed in this paper. For a bakery enterprise, the relevance of information quality can be illustrated through production planning. A demand forecast is useful only if the underlying sales information is sufficiently accurate and available at the appropriate time. Similarly, an inventory system can support cost control only if stock data are reliable and updated.

The implication is that the value of AI depends not only on the sophistication of the algorithm but also on the quality of the information infrastructure in which the algorithm operates.

Theme 3: AI applications in the bakery industry

The third theme concerns the specific characteristics of bakery production. Melesse and Orrù (2025) identify several Industry 4.0 technologies relevant to bakery operations, including automation, robotics, wireless sensor networks and digital platforms. Their review associate's digital transformation with real-time monitoring, traceability, inventory management, production efficiency and waste reduction.

These applications are directly relevant to management accounting.

Demand forecasting .AI-based forecasting can support production planning by estimating future demand. The importance of this application is demonstrated by Hübner et al. (2024), who

investigated machine-learning-based demand forecasting in a real bakery context. Their analysis of 2022 data found an average 30% reduction in bakery returns associated with the system studied.

This result should be interpreted carefully. It is evidence from a specific case, not an industry-wide estimate. Nevertheless, the case demonstrates a mechanism that is relevant to management accounting: *better forecast* → *improved production planning* → *potentially lower returns/waste* → *financial consequences*.

Inventory management. Bakery production requires continuous management of ingredients and finished products. Digital information can improve visibility over inventory and production requirements. AI can potentially combine historical consumption, sales forecasts and current inventory levels to support purchasing and production decisions.

Waste reduction. Waste has both operational and financial implications. When a bakery produces more than it can sell, the resulting waste affects material costs, labour utilisation and product profitability. AI-supported forecasting may therefore have consequences beyond operational efficiency.

Product profitability Combining sales, production and cost data can provide a more detailed view of product profitability. Management accounting can use such information to support decisions concerning product mix, pricing and production volumes.

Theme 4: Data quality and digital competencies

The fourth theme concerns the conditions required for AI adoption. AI cannot operate effectively without appropriate data. Uren and Edwards (2023) propose a technology-readiness model in which the traditional People–Processes–Technology perspective is extended by explicitly incorporating Data. Their research indicates that people, process and data readiness are necessary in addition to technological readiness for sustained AI implementation.

This finding is particularly relevant to management accounting. Accounting systems may contain large quantities of data, but volume does not guarantee quality. Inconsistent product codes, incomplete sales records, inaccurate inventory balances or poorly integrated systems can reduce the usefulness of AI-generated outputs.

The same issue appears in the OECD evidence. OECD (2025) identifies connectivity, data and AI-enabling resources, skills and finance as critical enablers of SME AI adoption. Skill shortages and financial constraints are identified as significant barriers. Digital competencies therefore represent a second important condition.

Cordos and Tiron-Tudor (2023) identify digital competencies as a distinct group within the accounting skill set. Their analysis includes data analytics, advanced IT, AI, databases and programming among relevant competencies. The implication is that AI adoption should not be viewed exclusively as an IT project. It also represents a competence-development process.

Theme 5: Ethical, organisational and professional challenges

The fifth theme concerns the risks associated with AI adoption. Zhang et al. (2023) examined the ethical impact of AI in managerial accounting through 47 interviews involving companies, an AI system vendor and regulators. Their findings identify data security, privacy and misuse, accountability, accessibility, transparency and trust as important ethical concerns.

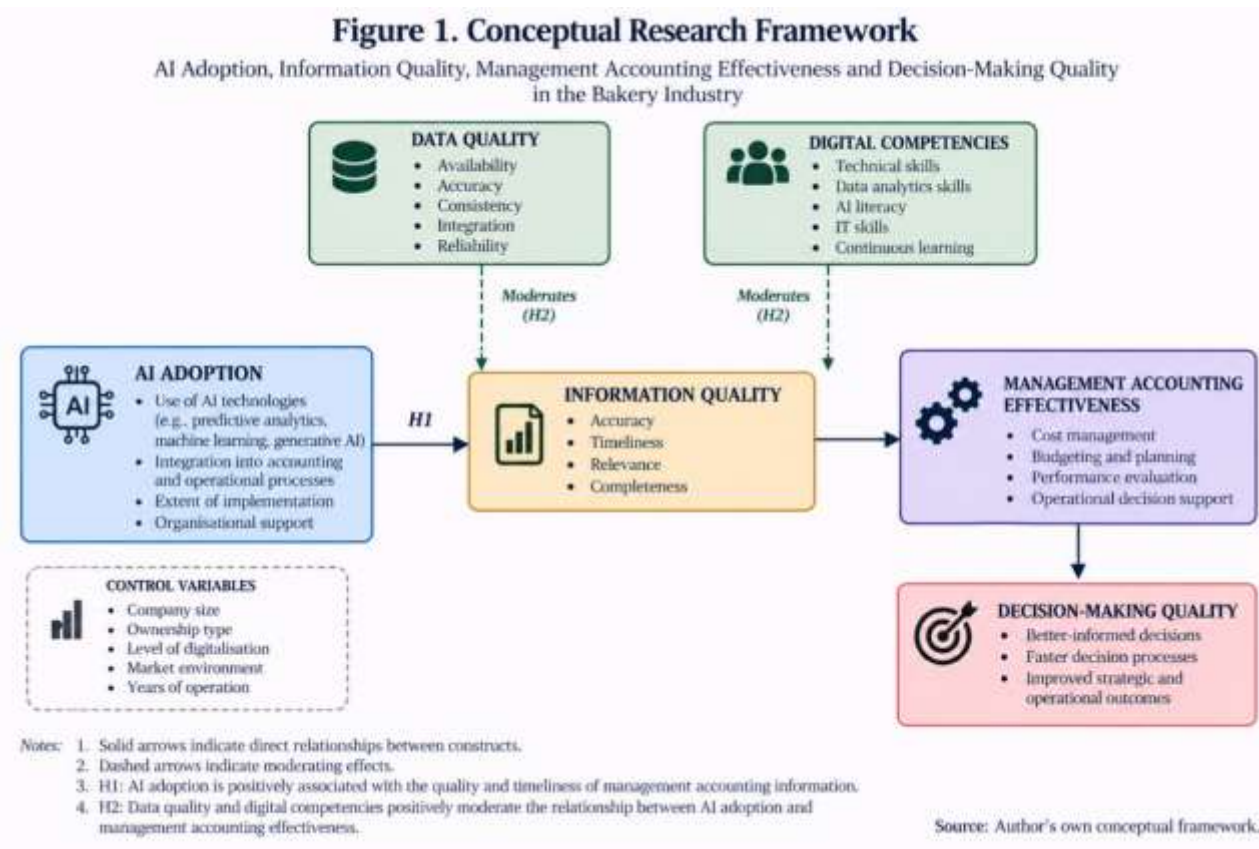
These concerns are relevant because management accounting information can influence decisions concerning costs, prices, investments, production and performance evaluation. An AI recommendation therefore cannot automatically be considered objective or correct. Human oversight remains necessary, particularly where decisions have significant financial or organisational consequences.

The professional transformation of accountants is another challenge. Leitner-Hanetseder et al. (2021) show that AI can change accounting tasks and roles and create new forms of human–technology collaboration.

Yigitbasioglu et al. (2023) similarly emphasise the combination of digital, generic and social capabilities in the transformation of accountants' advisory roles. The evidence therefore suggests that the future role of management accountants is likely to involve less emphasis on routine processing and greater emphasis on interpretation, professional judgement, communication and decision support.

5. Conceptual framework and research hypotheses

The thematic analysis indicates that AI adoption should not be considered independently from information quality, data quality and digital competencies. The conceptual framework proposed in this study is:



Source Author's own conceptual framework

The model is based on two propositions. First, AI adoption may improve the availability and processing of management accounting information. Second, the effect of AI depends on the quality of the underlying data and the ability of employees to use and interpret AI-supported information.

Hypothesis 1. Ratmono et al. (2023) provide empirical evidence that digitalisation in management accounting systems is positively associated with information accuracy and timeliness and that these characteristics contribute to decision-making effectiveness. The present research extends this relationship by focusing specifically on AI adoption in bakery enterprises.

H1: AI adoption is positively associated with the quality and timeliness of management accounting information in bakery enterprises. The hypothesis assumes that enterprises using AI more extensively are more likely to have management accounting information that is available rapidly, accurate and relevant to managerial decisions.

Hypothesis 2 The literature indicates that AI adoption depends on organisational readiness. Uren

and Edwards (2023) emphasise people, processes, technology and data readiness. OECD (2025) identifies data resources and skills among the key enablers of AI adoption by SMEs. Cordos and Tiron-Tudor (2023) similarly show that digital competencies represent an increasingly important component of the accounting professional profile.

Based on this convergence of evidence, the second hypothesis is formulated as follows:

H2: Data quality and digital competencies positively moderate the relationship between AI adoption and management accounting effectiveness in bakery enterprises.

This hypothesis is intentionally more demanding than a simple relationship between AI adoption and performance. It proposes that AI generates greater value when organisations have reliable data and employees capable of using digital technologies.

6. Proposed empirical methodology

Research design

The empirical component is designed as a cross-sectional quantitative survey of enterprises operating in the bakery industry. The target respondents include:

- owners and administrators;
- general managers;
- financial managers;
- accountants;
- management accountants;
- controllers;
- economists;
- employees involved in digitalisation or financial decision-making.

The questionnaire is designed to measure the constructs identified in the thematic literature review. No empirical results are reported at this stage because the questionnaire has not yet been administered.

Measurement model

The principal constructs are:

Tabel 2: Measurement model

Construct	Code	Measurement
AI adoption	AI	6 items
Digitalisation of management accounting	DIMAS	4 items
Information quality	IQ	5 items
Management accounting effectiveness	MAE	5 items
Decision-making effectiveness	DME	6 items
Data quality	DQ	6 items
Digital competencies	DC	6 items
Perceived AI benefits	B	7 items

Source: Author

The items are based on the concepts identified in the literature, particularly the management accounting digitalisation framework of Ratmono et al. (2023), the organisational readiness perspective of Uren and Edwards (2023), the digital accounting competencies identified by Cordos and Tiron-Tudor (2023), and the bakery-specific applications identified by Melesse and Orrù (2025).

Questionnaire scale

Unless otherwise specified, the questionnaire uses a five-point Likert scale:

- 1 – Strongly disagree
- 2 – Disagree
- 3 – Neither agree nor disagree
- 4 – Agree
- 5 – Strongly agree

The questionnaire also includes categorical questions concerning company size, respondent position, AI adoption level and the types of technologies currently used.

Data analysis

The empirical analysis should proceed in several stages. First, descriptive statistics will be used to characterise the sample. Second, the reliability of the measurement scales should be assessed using Cronbach's alpha and, where appropriate, composite reliability. Third, construct validity should be examined through convergent and discriminant validity. Fourth, correlations between the principal constructs should be calculated. Finally, the hypotheses should be tested using regression or structural equation modelling, depending on the final sample size and measurement model.

7. Discussion

The thematic analysis indicates that the potential contribution of AI to management accounting in the bakery industry lies primarily in the integration of operational and financial information. The literature does not support the conclusion that AI automatically improves organisational performance. Instead, the evidence points towards a conditional relationship.

Digital technologies can increase the availability and speed of information. AI can add predictive and analytical capabilities. However, these capabilities depend on the quality of the underlying data and on employees' ability to interpret and use the outputs. This conclusion is consistent with Ratmono et al. (2023), whose findings indicate that digitalisation contributes to decision-making through improvements in information quality and cost-related outcomes rather than through a simple direct relationship.

The bakery industry strengthens this argument because operational decisions are highly time sensitive. A forecast that arrives after production has already been scheduled has limited managerial value. Similarly, inventory information is useful only if it reflects actual stock conditions. Consequently, timeliness becomes particularly important in bakery management accounting.

The industry also provides an interesting context for studying the relationship between AI and waste. The bakery case analysed by Hübner et al. (2024) demonstrates that machine-learning-based forecasting can have operational and environmental implications. From a management accounting perspective, the same mechanism can have financial implications. Reduced returns and waste may influence material consumption, production costs and product profitability. However, these effects need to be measured empirically rather than assumed.

Another important finding concerns competencies. The transformation of management accounting does not eliminate the need for accounting knowledge. Instead, traditional accounting knowledge combined with digital and analytical competencies.

This conclusion is consistent with Cordos and Tiron-Tudor (2023), whose analysis identifies technical, digital and soft competencies as complementary components of the future accounting profile. The findings also support the idea that AI adoption represents an organisational

transformation rather than a software acquisition decision. Uren and Edwards (2023) emphasise that AI implementation requires readiness in people, processes, technology and data.

This is particularly relevant for SMEs. OECD evidence shows that SME AI adoption remains below that of large firms and that skills, data resources, connectivity and finance represent important enabling conditions. The ethical dimension should also remain part of the management accounting discussion. Zhang et al. (2023) show that data security, privacy, accountability and transparency represent significant concerns in AI-based managerial accounting.

The appropriate response is not necessarily to avoid AI, but to establish appropriate governance and human oversight. The European Union's Artificial Intelligence Act provides a broader regulatory framework for AI systems. Regulation (EU) 2024/1689 establishes harmonised rules on artificial intelligence and entered into force in 2024, with provisions applying progressively.

For bakery enterprises, particularly SMEs, this regulatory environment reinforces the importance of understanding not only the technological benefits of AI but also its governance implications.

8. Practical implications

The findings have several practical implications:

First, bakery enterprises should consider AI adoption as part of an integrated digital transformation strategy rather than as an isolated technology investment.

Second, management accounting systems should be connected with operational data where this can improve forecasting, cost analysis and control.

Third, companies should evaluate data quality before implementing advanced AI applications. Poor-quality data may reduce the reliability of AI-generated outputs.

Fourth, employee training should accompany technological implementation. Accountants and managers need sufficient digital literacy to interpret AI-supported analyses and identify potential limitations.

Fifth, human oversight should remain part of important managerial decisions. AI-generated recommendations should be treated as decision-support information rather than as autonomous managerial decisions.

Finally, SMEs may need to adopt a gradual implementation strategy. OECD evidence indicates that AI adoption follows different organisational paths and that SMEs differ in digital maturity and scope of AI use.

9. Conclusions

Artificial intelligence is changing the technological and organisational environment in which management accounting operates. The transformation extends beyond the automation of accounting procedures. It affects the speed, volume and nature of information available for managerial analysis.

The bakery industry represents a relevant context for studying this transformation because production decisions are closely connected to demand forecasting, inventory, raw material consumption, product perishability and waste.

The thematic literature review identified five interconnected areas: the transformation of management accounting, information quality and decision-making, bakery-specific AI applications, data quality and digital competencies, and ethical and professional challenges.

The literature suggests that AI can support demand forecasting, inventory management, cost analysis, production planning and decision support. However, these benefits depend on the organisational context in which AI is implemented.

The first hypothesis proposes that AI adoption is positively associated with the quality and

timeliness of management accounting information. The second proposes that data quality and digital competencies strengthen the relationship between AI adoption and management accounting effectiveness.

The conceptual framework developed in this study provides a basis for empirical investigation. The proposed questionnaire translates the theoretical constructs into measurable variables and allows the research to move from conceptual analysis towards quantitative testing.

The main contribution of the paper lies in connecting the literature on AI and management accounting with the specific operational characteristics of the bakery industry. Rather than treating AI adoption as an isolated technological phenomenon, the study positions it within a broader system involving information quality, data, human competencies and managerial decision-making.

Future research should therefore test the proposed model using primary data collected from bakery enterprises. Attention should be given to whether AI adoption improves information quality and whether data quality and digital competencies significantly influence the resulting effectiveness of management accounting.

Limitations of the documentation

The principal limitation concerns the specific intersection of AI, management accounting and the bakery industry. Literature is considerably richer when the three components are analysed separately than when they are examined together.

The bakery-specific evidence identified in this review focuses primarily on Industry 4.0, forecasting, automation, inventory, production efficiency and waste. Direct empirical studies connecting these technologies to management accounting effectiveness remain limited. For this reason, the paper does not claim that AI produces a specific percentage improvement in profitability, costs or decision-making across bakery enterprises. The 30% reduction in bakery returns reported by Hübner et al. (2024) is explicitly treated as the result of a particular case study and is not generalised to the industry.

A second limitation is methodology. The present paper establishes a thematic literature review and an empirically testable framework, but the questionnaire has not yet been administered. Consequently, H1 and H2 remain research hypotheses, not empirically confirmed findings.

A third limitation concerns the rapid development of AI technologies. Evidence concerning generative AI and large language models is developing quickly, meaning that future versions of the literature review should update the evidence base.

Finally, although the study prioritises peer-reviewed and official sources, it does not claim to constitute a fully exhaustive systematic review with a PRISMA-style numerical screening process. The objective is thematic synthesis and theory development rather than bibliometric measurement.

Future research should further develop and empirically validate the proposed research framework and questionnaire. Before the full-scale distribution of the questionnaire, a pilot test involving approximately 10–15 respondents with relevant professional experience in accounting, management accounting, digital technologies, or the bakery sector should be conducted. The pilot stage will allow the assessment of item clarity, wording, relevance, response consistency, and the overall usability of the instrument. Based on the feedback obtained, potentially ambiguous or redundant items may be revised before the final questionnaire is administered.

Following the pilot stage, an a priori sample size calculation should be performed in order to determine the minimum number of respondents required for the empirical testing of H1 and H2. The final sample size should therefore be established on the basis of the selected statistical approach, the expected effect size, the desired statistical power, and the number of predictors included in the models, rather than being determined solely by practical accessibility. This

approach would strengthen the methodological robustness of the subsequent empirical study and provide an appropriate basis for testing the proposed relationships between AI adoption, information quality, data quality, digital competencies, and management accounting effectiveness. The empirical phase may subsequently provide the basis for a more extensive study or a separate research paper focused on the quantitative validation of the proposed conceptual framework

Appendix 1. Proposed questionnaire

Artificial Intelligence and Management Accounting in the Bakery Industry

Section A. Respondent profile

1. Position

- Owner / Administrator
- General Manager
- Financial Manager
- Accountant
- Chief Accountant
- Management Accountant / Controller
- Economist
- IT / Digitalisation Specialist
- Other

2. Professional experience

- Less than 3 years
- 3–5 years
- 6–10 years
- 11–20 years
- More than 20 years

3. Enterprise size

- Microenterprise
- Small enterprise
- Medium-sized enterprise
- Large enterprise

4. Number of employees

- 1–9
- 10–49
- 50–249
- 250+

5. Main activity

- Bread production
- Bakery products
- Pastry products
- Confectionery
- Mixed production
- Production + retail
- Other

Section B. Digitalisation of management accounting

1 = Strongly disagree; 5 = Strongly agree

DIMAS1. The company uses digital systems to collect and process information required for management accounting.

DIMAS2. Management accounting processes in the company are largely digitalised.

DIMAS3. Financial and operational information can be integrated through the systems used

by the company.

DIMAS4. Digitalisation has reduced the time required to prepare information for management.

Section C. Artificial intelligence adoption

AI1. The company currently uses technologies based on artificial intelligence.

AI2. AI is used to analyse financial or operational data.

AI3. AI is used for forecasting or estimating future business developments.

AI4. The company uses AI to automate selected business processes.

AI5. The use of AI within the company has increased during the last three years.

AI6. Management intends to expand the use of AI during the next two to three years.

Type of AI technologies currently used

Select all applicable:

- Machine learning / predictive analytics
- AI-based sales forecasting
- AI-based inventory management
- AI-based production planning
- AI-based accounting applications
- Generative AI
- Automated document processing / OCR
- Computer vision
- Other
- We do not currently use AI
- I do not know

Section D. Information quality

IQ1. The accounting information available to management is accurate.

IQ2. Accounting information is available sufficiently quickly for managerial decision-making.

IQ3. The information provided by digital systems is relevant to managerial decisions.

IQ4. Digital systems reduce errors in the processing of accounting information.

IQ5. Financial and operational information can be combined effectively for management analysis.

Section E. Management accounting effectiveness

MAE1. Digital systems enable the company to identify cost variances more rapidly.

MAE2. The company can analyse product costs more efficiently.

MAE3. Production costs can be monitored more effectively using digital systems.

MAE4. Digital systems support more effective production planning.

MAE5. Digital systems help identify operational problems with financial consequences more rapidly.

Section F. Decision-making effectiveness

DME1. Available information enables management to make decisions more rapidly.

DME2. Accounting information contributes to better-informed managerial decisions.

DME3. Digital systems improve the company's ability to anticipate future developments.

DME4. Digital information is useful for production-related decisions.

DME5. Digital information is useful for decisions concerning pricing and product profitability.

DME6. Available information contributes to better planning and control.

Section G. Data quality

DQ1. Sales data are complete and available in a form suitable for analysis.

DQ2. Inventory data are updated in a timely manner.

DQ3. Production data are sufficiently accurate for management analysis.

DQ4. Financial and operational data can be integrated across the systems used by the company.

DQ5. The company has procedures for verifying data quality.

DQ6. Historical data are sufficiently available to support predictive analysis.

Section H. Digital competencies

DC1. Employees involved in accounting have the digital competencies required to use current systems.

DC2. Employees are able to interpret information generated by digital tools.

DC3. The company provides training concerning new digital technologies.

DC4. Accounting employees have sufficient data-analysis skills.

DC5. Management understands the main opportunities and limitations associated with AI.

DC6. The company has employees capable of collaborating with IT specialists when implementing AI solutions.

Section I. Perceived benefits of AI

To what extent do you agree that AI can:

B1. improve demand forecasting;

B2. contribute to reducing food waste;

B3. improve inventory management;

B4. improve production planning;

B5. contribute to identifying more profitable products;

B6. reduce the time required for management analysis;

B7. improve managerial decision-making.

Section J. Barriers to AI adoption

Which are the main barriers to AI adoption in your company?

Select up to five:

- Implementation costs
- Lack of digital skills
- Lack of specialised personnel
- Insufficient data quality
- Difficulties integrating existing systems
- Insufficient IT infrastructure
- Employee resistance to change
- Data security risks
- Lack of transparency of AI outputs
- Difficulty explaining AI-generated recommendations
- Uncertain return on investment
- Lack of an AI strategy
- Regulatory uncertainty
- Other

Section K. Open question

In your opinion, what is the most important change that artificial intelligence could produce in management accounting within a bakery enterprise?

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