Future of Work and Digital Management Journal

Article type:
Original Research

Article history:
Received 06 May 2026
Revised 25 June 2026
Accepted 05 August 2026
Initial Publish 24 August 2026
Published online 01 November 2026

An Investigation of Management Practices in Raw Material Cost Accounting: Evidence from Iraqi Industrial Companies

Ali. Awadh Atshan[1], Javad. Rezazadeh [2*], Sahar. Sepasi[2]

1 PhD student, Department of Accounting, Faculty of Management and Economics, Tarbiat Modares University, Tehran, Iran
2 Associate Professor, Department of Accounting, Faculty of Management and Economics, Tarbiat Modares University, Tehran, iran

Corresponding author email address:
j.rezazadeh@modares.ac.ir

How to cite this article:
Awadh Atshan, A., Rezazadeh, J., & Sepasi, S. (2026). An Investigation of Management Practices in Raw Material Cost Accounting: Evidence from Iraqi Industrial Companies. *Future of Work and Digital Management Journal, 4*(6), 1-20. https://doi.org/10.61838/fwdmj.320

ABSTRACT

This study aimed to investigate management practices in raw material cost accounting and their effects on cost control and optimization in Iraqi industrial companies. In terms of purpose, the study was applied, and in terms of nature, it employed a descriptive-correlational survey design. The statistical population consisted of financial managers, cost accountants, and cost-control specialists working in Iraqi industrial companies. Using Cochran's formula, the sample size was determined to be 384 participants, who were selected through stratified random sampling. Data were collected using a researcher-developed questionnaire comprising 25 items rated on a five-point Likert scale. Descriptive statistics, Spearman's rank-order correlation test, and multiple linear regression analysis were performed using SPSS software. The results showed that raw material cost-management challenges had the highest mean score of 4.10 out of 5, whereas raw material inventory and consumption management had the lowest mean score of 3.25. The most important challenges were severe fluctuations in raw material prices and supply chain disruptions. The hypothesis-testing results also indicated that cost-management practices ($\beta = 0.34$) and inventory management ($\beta = 0.29$) had positive and statistically significant effects on cost control, whereas cost-management challenges ($\beta = -0.22$) had a negative and statistically significant effect. The regression model explained 52.4% of the variance in the dependent variable. Iraqi industrial companies face serious challenges in managing raw material costs, primarily arising from external factors, including price fluctuations and supply chain disruptions, as well as internal weaknesses, such as inadequate information systems and traditional inventory-management practices. Strengthening cost-management practices and improving inventory management can contribute substantially to reducing costs and increasing the profitability of these companies.

Keywords: cost accounting, raw material cost management, inventory management, cost control, Iraqi industrial companies, supply chain challenges.

Introduction

Raw materials constitute one of the most important cost components in industrial production and frequently account for a substantial proportion of total manufacturing expenditure. The manner in which these materials are procured, received, stored, transferred, consumed, measured, and reported directly affects production efficiency, product pricing, profitability, working-capital requirements, and the overall competitiveness of manufacturing firms. Raw material cost accounting therefore extends beyond the routine recording of purchase prices and quantities; it represents an integrated managerial process through which organizations identify material-related costs, analyze deviations, reduce waste, improve resource allocation, and support operational and strategic decision-making. This function is particularly critical in industries characterized by complex production processes, volatile input prices, imported materials, long replenishment periods, and uncertain demand. Effective raw materials management requires coordination among accounting, procurement, production, warehousing, quality control, and supply chain units so that material availability can be maintained without excessive inventory accumulation or avoidable production losses [1, 2].

Traditional cost accounting systems generally emphasize the monetary value of materials entering the production process, but contemporary industrial conditions require a broader understanding of material costs. Purchase prices represent only one dimension of raw material expenditure. Transportation, handling, inspection, storage, obsolescence, deterioration, waste, rework, production interruption, emergency procurement, and inventory financing may all contribute to the actual economic cost of raw materials. When such costs are not accurately identified or assigned, managers may receive incomplete information about product profitability and operational performance. Weak cost information can also conceal inefficient material consumption and lead to inappropriate pricing, budgeting, and investment decisions. For this reason, the planning and accounting of material costs should be aligned with maintenance requirements, production schedules, quality standards, inventory policies, and organizational performance indicators [2, 3].

Strategic cost management provides a framework through which manufacturing companies can connect cost information with competitive priorities, operational capabilities, and long-term sustainability. Unlike conventional cost-reduction approaches that may focus on short-term expenditure cuts, strategic cost management seeks to understand the structural and operational drivers of costs and to eliminate activities that do not generate value. In manufacturing environments, effective strategic cost management may involve supplier evaluation, variance analysis, target costing, activity-based analysis, process redesign, waste prevention, performance measurement, and cross-functional coordination. Its implementation can help companies overcome cost rigidity, respond to environmental uncertainty, and strengthen corporate sustainability [4]. Empirical evidence also indicates that systematic cost-reduction strategies can improve resource utilization and operational performance when they are supported by accurate accounting data, managerial commitment, and well-defined control mechanisms [5].

One of the most significant developments in raw material cost accounting is material flow cost accounting. Material flow cost accounting traces the physical and monetary flows of materials throughout production processes and distinguishes between the costs associated with positive products and those associated with material losses. Under this approach, waste is not treated merely as a physical or environmental problem; it is recognized as a cost-bearing output that absorbs material, energy, labor, and system-related expenditures. By assigning monetary values to material losses, material flow cost accounting enables managers to identify hidden inefficiencies that may not be visible in conventional accounting reports. This approach can improve management decision-making, facilitate cleaner production, reduce resource losses, and support progress toward sustainable development objectives [6, 7].

The application of material flow cost accounting is particularly relevant when manufacturing processes involve defective products, rework, scrap, or variable raw material quality. Low-quality inputs may initially appear less expensive but can generate substantial downstream costs through production delays, higher rejection rates, increased energy consumption, reprocessing, and waste disposal. Accordingly, raw material purchasing decisions should not be based exclusively on acquisition price. The economic consequences of material quality must be assessed across the entire production process. Optimization models based on material flow cost accounting can assist organizations in determining appropriate raw material quality levels by balancing purchase costs against rework and material-loss costs [8]. Case-based evidence further suggests that material flow cost accounting can influence corporate practices by improving cost transparency, enhancing employee awareness, and directing managerial attention toward resource inefficiencies [9].

Inventory management is another central component of raw material cost control. Manufacturing firms must maintain sufficient inventories to prevent interruptions while avoiding excessive stocks that increase storage costs, working-capital requirements, deterioration, and obsolescence. Ineffective inventory policies may create simultaneous shortages and surpluses because materials are not coordinated with actual production demand. Material requirements planning can improve procurement timing and quantities by integrating bills of materials, production schedules, current stock levels, and lead-time information. The methodological application of material requirements planning has demonstrated its potential to improve material supply and reduce deficiencies in production environments [10]. More broadly, digital technologies can support inventory visibility, automated monitoring, forecasting, traceability, and real-time decision-making, thereby strengthening the accuracy and responsiveness of inventory-management systems [11].

Digital transformation has altered the scope and methods of cost management in manufacturing companies. Enterprise resource planning systems, industrial sensors, cloud computing, data analytics, artificial intelligence, and integrated accounting platforms allow organizations to collect and process detailed cost and operational data. These technologies can link material purchases with warehouse movements, production consumption, product outputs, waste volumes, and financial results. Digital transformation can therefore improve the timeliness, accuracy, and analytical value of cost information and support more responsive cost-management decisions [12]. However, digitalization does not automatically improve organizational performance. The effectiveness of such technologies depends on data quality, process integration, staff capabilities, technological infrastructure, managerial support, and the alignment of information systems with production and accounting requirements.

The Internet of Things and blockchain technologies have also attracted increasing attention in inventory and supply chain management. Internet of Things devices can provide continuous information on inventory quantities, location, storage conditions, movement, and consumption, whereas blockchain can create tamper-resistant and traceable records of transactions across supply chain participants. Their combined use may enhance transparency, coordination, and trust among suppliers, manufacturers, logistics providers, and customers [13]. Blockchain technology may also support sustainable supply chains by improving provenance verification, data integrity, accountability, and the visibility of environmental and social practices [14]. Nevertheless, blockchain adoption presents challenges related to cost, technological complexity, interoperability, governance, confidentiality, legal uncertainty, and organizational readiness [15].

The growing volatility of international markets has made raw material procurement more complex. Industrial companies frequently operate under conditions in which prices, exchange rates, transportation costs, lead times, production requirements, and supplier capacities fluctuate simultaneously. Under such circumstances, fixed procurement plans may rapidly become ineffective. Data-driven optimization can improve procurement decisions by incorporating uncertainty in raw material prices and production demand and by evaluating alternative purchasing quantities and timing strategies [16]. Flexible procurement and production strategies are especially important when manufacturers face disruptions, demand changes, and supply constraints. Flexible business strategies can strengthen supply chain responsiveness by enabling firms to adjust sourcing, production, inventory, and distribution decisions as conditions change [17].

Supply chain disruptions can produce severe consequences for raw material cost management. Delayed shipments, supplier failure, political instability, transportation interruptions, border restrictions, energy shortages, and sudden demand changes can increase purchase prices, force emergency sourcing, disrupt production schedules, and reduce capacity utilization. These consequences became particularly visible during large-scale global disruptions, demonstrating that cost efficiency without resilience can expose manufacturing firms to substantial operational risks. Disruption-mitigation strategies may include supplier diversification, safety-stock policies, collaborative planning, information sharing, flexible contracts, local sourcing, and contingency arrangements [18]. Sustainable smart supply chain frameworks similarly emphasize the integration of digital technologies, resilience, environmental responsibility, and strategic coordination to improve the ability of manufacturing firms to manage uncertainty [19].

Organizational conditions also influence the effectiveness of supply chain and cost-management practices. Even advanced accounting or inventory systems may produce limited benefits when departments operate in isolation or when organizational culture discourages collaboration and information sharing. Procurement staff may prioritize purchase-price reductions, production units may emphasize uninterrupted output, warehouse personnel may focus on stock availability, and accounting units may concentrate on budget compliance. Without shared objectives, these priorities can conflict and create hidden costs. Research on organizational culture and supply chain performance indicates that cultural attributes shape interdepartmental relationships, adaptability, coordination, and operational outcomes [20]. Therefore, raw material cost control should be understood as an organization-wide managerial responsibility rather than an isolated accounting function.

Lean manufacturing offers another relevant perspective because it seeks to eliminate non-value-adding activities and improve the flow of materials and information. Lean practices can reduce excess inventory, waiting time, defects, overproduction, unnecessary movement, and inefficient processing. These improvements can lower raw material costs and increase the visibility of material losses throughout production systems. Evidence indicates that lean manufacturing can contribute to sustainable performance by connecting operational efficiency with environmental and social improvements [21]. The effects of lean practices may be further strengthened when leanness is combined with organizational innovativeness, because innovative firms are better positioned to redesign processes, adopt new technologies, and respond to changing market conditions [22].

Sustainable production has expanded the objectives of raw material management beyond financial cost minimization. Manufacturers are increasingly expected to reduce resource depletion, waste generation, emissions, and adverse environmental effects while maintaining productivity and profitability. Sustainable consumption and production approaches emphasize efficient resource use, lifecycle thinking, cleaner technologies, waste prevention, and responsible supply chain practices [23]. Companies must therefore assess whether their manufacturing practices are economically, operationally, and environmentally sustainable. However, evaluating sustainable manufacturing practices requires appropriate metrics, consistent data, and assessment frameworks that capture the multidimensional nature of sustainability [24]. Bottom-up methods for developing key performance indicators can help organizations identify process-specific measures that reflect material efficiency, energy use, waste, quality, productivity, and environmental performance [3].

The relationship between environmental capabilities and organizational performance further demonstrates that sustainability-oriented material management may generate strategic benefits. Green capabilities include the organizational knowledge, technologies, routines, and managerial competencies needed to reduce environmental impacts and improve resource efficiency. Such capabilities can strengthen performance by reducing waste, supporting innovation, improving regulatory compliance, and enhancing stakeholder relationships [25]. Supply chain sustainability innovation frameworks similarly highlight the need to integrate environmental and social considerations into supplier selection, process improvement, technological adoption, performance measurement, and collaborative decision-making [26]. These perspectives suggest that effective raw material cost accounting can serve not only financial control but also broader organizational sustainability.

Industrial symbiosis offers an additional mechanism for improving material efficiency by allowing the waste or by-products of one organization to become inputs for another. Although this arrangement can reduce raw material consumption and disposal costs, it also creates coordination, contracting, information, and transaction-cost challenges. The allocation and dynamics of transaction costs influence whether industrial symbiosis relationships remain economically viable and stable over time [27]. Cost accounting systems must therefore be capable of measuring not only internal material flows but also interorganizational exchanges and the costs associated with establishing and maintaining collaborative resource networks.

Despite the availability of modern cost-accounting methods and digital technologies, many manufacturing companies continue to rely on conventional inventory records, fragmented information systems, periodic physical counts, and reactive cost controls. Such practices limit managers' ability to identify material losses promptly or distinguish between controllable and externally imposed cost increases. The coexistence of advanced production requirements with underdeveloped accounting and information systems can be especially problematic in environments characterized by infrastructural limitations, economic volatility, and supply chain uncertainty. Under these conditions, cost reports may be delayed, inventory balances may be inaccurate, and procurement decisions may be made without reliable forecasts or integrated production data.

Iraqi industrial companies operate within a context in which raw material management may be affected by price volatility, import dependence, logistics constraints, exchange-rate movements, unstable supply conditions, technological limitations, and shortages of specialized personnel. These factors can increase the gap between planned and actual material costs and make it difficult to maintain consistent production and profitability. At the same time, internal weaknesses in inventory planning, information sharing, cost-variance analysis, warehouse systems, and cross-functional coordination may intensify the effects of external uncertainty. The combined examination of cost-management practices, inventory and consumption management, and cost-related challenges is therefore essential for understanding the actual ability of industrial companies to control and optimize raw material costs.

Previous research has provided substantial evidence regarding strategic cost management, material flow cost accounting, sustainable supply chains, lean manufacturing, digital inventory systems, supply chain resilience, and procurement optimization. Nevertheless, these streams of research are often examined separately. Studies may focus on a specific accounting technique, technological solution, sustainability practice, or supply chain risk without simultaneously evaluating how managerial cost practices, inventory management, and operational challenges jointly influence raw material cost control. Moreover, the findings obtained in highly digitalized or economically stable manufacturing contexts may not be directly transferable to Iraqi industrial companies, where institutional, technological, infrastructural, and market conditions may differ considerably.

A context-specific assessment is consequently necessary to determine the current level of raw material cost-management practices in Iraqi industrial companies, identify the most serious internal and external challenges, and estimate the relative contribution of cost-management and inventory practices to cost control and optimization. Such evidence can help financial managers, cost accountants, production managers, and policymakers prioritize interventions, improve information systems, modernize warehousing practices, strengthen procurement planning, and develop more resilient and sustainable industrial operations.

Accordingly, the aim of this study was to investigate raw material cost-management practices and determine the effects of cost-management practices, raw material inventory and consumption management, and raw material cost-management challenges on raw material cost control and optimization in Iraqi industrial companies.

Methodology

The present study was classified as applied research in terms of purpose because its findings can be directly used to improve raw material cost-management processes in Iraqi industrial companies. In terms of nature and implementation method, the study employed a descriptive-correlational survey design. This type of research seeks to describe the current status of variables and examine the relationships among them without the researcher's direct intervention in real-world conditions. The study was also cross-sectional because the data were collected and analyzed within a specific period. The relationships among raw material cost-management practices, raw material inventory and consumption management, and challenges within the costing system were examined. Data were collected using both library-based and field methods.

Theoretical information was collected through a review of books, domestic and international scientific articles, theses, and reliable sources available in international scientific databases. This stage was conducted to explain the theoretical foundations of cost accounting and raw material management and to identify the relevant indicators. The primary research data were collected by distributing questionnaires among financial managers, cost accountants, and specialists working in Iraqi industrial companies. These data were collected directly from actual organizational settings and formed the basis of the statistical analyses.

The statistical population of the present study consisted of all financial managers, cost accountants, production managers, and cost-control specialists employed in industrial companies operating in Iraq. Because these individuals were directly familiar with cost-management processes, cost accounting, and raw material control, they were considered the most appropriate sources of information for assessing the existing conditions. The statistical population was treated as unlimited because the exact number of eligible individuals across all industrial companies could not be determined. The sample size was calculated using Cochran's formula for unlimited populations. Given a 95% confidence level, a 5% margin of error, and the assumption of maximum variance ($p = q = 0.5$), the required sample size was estimated at 384 participants. Considering the limitations associated with access to the actual statistical population of Iraqi industrial companies, 384 questionnaires were designated as the target sample, and efforts were made to collect the same number of valid questionnaires.

Stratified random sampling was employed in this study. First, industrial companies were classified according to their type of activity, including metal, chemical, food-processing, and manufacturing industries. Eligible participants were then randomly selected from each stratum. This method ensured that the selected sample adequately represented the occupational and industrial structure of the overall statistical population and reduced sampling bias.

The primary data-collection instrument was a structured, researcher-developed questionnaire designed according to the theoretical foundations, previous research, and objectives of the study. The questionnaire was developed to accurately measure the main research variables, including raw material cost-management practices, raw material inventory and consumption management, and raw material cost-management challenges. It consisted of a series of items rated on a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree, with each item representing one dimension of the research variables. The items were developed on the basis of previous studies and reliable scientific sources to establish the instrument's content validity. Content validity was assessed by submitting the questionnaire to several experts in cost accounting and financial management. Necessary revisions were made according to their comments to ensure the conceptual and structural accuracy of the instrument. Cronbach's alpha coefficient was also used to assess the reliability of the questionnaire. The results demonstrated that the instrument had satisfactory internal consistency and was suitable for statistical analysis. The collected data were analyzed using descriptive and inferential statistical methods to scientifically and accurately examine the relationships among the variables. Descriptive statistics, including the mean, standard deviation, minimum, maximum, frequency, and percentage, were used to describe the overall status of the research variables and the demographic characteristics of the sample. In the inferential statistics section, appropriate statistical tests were used to examine the research hypotheses and analyze the relationships among the variables. Specifically, Pearson's correlation test was initially considered to assess the relationships among the variables, and linear regression analysis was used to determine the effects of cost-management practices on raw material cost control. Before conducting the inferential tests, statistical assumptions, including normality of data distribution, linearity of relationships, absence of multicollinearity, independence of errors, and homogeneity of variances, were examined. When the assumption of normality was not satisfied, alternative nonparametric tests, such as Spearman's correlation test, were used. Cronbach's alpha and composite reliability (CR) were used to assess the reliability of the research instrument, whereas convergent validity, measured through the average variance extracted (AVE), and discriminant validity were evaluated to establish the validity of the measurement instrument. In the regression analysis, in addition to standardized and unstandardized coefficients, significance indices, including the t statistic and p value, and the coefficient of determination (R^2) were used to evaluate the predictive power of the model. The F test was also used to assess the overall significance of the regression model. All analyses were conducted using SPSS statistical software to ensure computational accuracy and the validity of the results.

Findings and Results

In this section, descriptive statistical indices, including the mean, median, mode, standard deviation, minimum, and maximum, were calculated and reported for the four main research variables: raw material cost-management practices, raw material inventory and consumption management, raw material cost-management challenges, and raw material cost control and optimization. Table 1 presents these indices.

Table 1

Measures of Central Tendency and Dispersion for the Main Research Variables

Variable	N	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Raw material cost-management practices	384	3.35	3.40	3.30	0.62	2.10	4.80
Raw material inventory and consumption management	384	3.25	3.30	3.20	0.68	1.80	4.90
Raw material cost-management challenges	384	4.10	4.10	4.00	0.55	2.70	5.00
Raw material cost control and optimization	384	3.85	3.90	3.80	0.65	2.40	5.00

As shown in Table 1, the mean score for raw material cost-management practices was 3.35 out of 5, indicating a moderate-to-favorable level of this component in Iraqi industrial companies. The standard deviation of 0.62 indicates a relatively appropriate dispersion of responses. The maximum score recorded for this variable was 4.80, whereas the minimum was 2.10, indicating that respondents held different views regarding this component.

The raw material inventory and consumption management variable had a mean score of 3.25 out of 5, representing the lowest level among the independent variables. This finding indicates a relative weakness in raw material inventory and consumption management in Iraqi industrial companies. The standard deviation of 0.68 reflects relatively high variability in responses to this variable.

The raw material cost-management challenges variable had a mean score of 4.10 out of 5, the highest mean among the research variables. This result indicates the existence of numerous serious challenges in raw material cost management in Iraqi industrial companies from the respondents' perspective. The standard deviation of 0.55 indicates a relatively high level of agreement among respondents regarding the existence of these challenges.

The dependent variable, raw material cost control and optimization, had a mean score of 3.85 out of 5, indicating a relatively favorable level. This finding suggests that Iraqi industrial companies have been able to control and optimize raw material costs to a relatively satisfactory extent, although further improvement remains necessary. The standard deviation of 0.65 indicates an appropriate dispersion of responses.

Based on the findings presented in Table 1, it can be concluded that respondents perceived raw material cost-management challenges as the most prominent variable, followed by raw material cost control and optimization, cost-management practices, and raw material inventory and consumption management. This finding demonstrates that despite numerous challenges, Iraqi industrial companies have been able to control their costs to a relatively satisfactory extent. Nevertheless, they continue to experience substantial weaknesses in raw material inventory and consumption management.

The research questionnaire consisted of 25 items that separately assessed the different dimensions of the research variables. This section presents the frequency distribution, percentage, mean, and standard deviation for each questionnaire item. Responses were measured on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Table 2

Descriptive Statistics for the Questionnaire Items

A. Items Related to Raw Material Cost-Management Practices

No.	Item	1, n (%)	2, n (%)	3, n (%)	4, n (%)	5, n (%)	Mean	SD
1	Use of cost accounting systems in the company	21 (5.4)	67 (17.5)	102 (26.7)	129 (33.6)	65 (16.8)	3.42	1.14
2	Regular analysis of raw material cost variances	26 (6.7)	82 (21.2)	112 (29.1)	110 (28.6)	54 (14.4)	3.22	1.14
3	Precise planning for raw material procurement	17 (4.4)	57 (14.8)	99 (25.9)	135 (35.2)	76 (19.7)	3.51	1.11
4	Use of modern cost-management methods	22 (5.8)	70 (18.3)	109 (28.4)	115 (29.9)	68 (17.6)	3.36	1.14
5	Continuous control of raw material consumption on production lines	16 (4.3)	48 (12.5)	89 (23.3)	140 (36.5)	91 (23.4)	3.63	1.09
6	Use of performance indicators to evaluate costs	18 (4.6)	63 (16.5)	106 (27.6)	126 (32.8)	71 (18.5)	3.44	1.12

B. Items Related to Raw Material Inventory and Consumption Management

No.	Item	1, n (%)	2, n (%)	3, n (%)	4, n (%)	5, n (%)	Mean	SD
7	Precise planning of raw material inventory	26 (6.9)	89 (23.2)	110 (28.7)	107 (27.9)	52 (14.3)	3.19	1.16
8	Precise control of materials entering and leaving the warehouse	16 (4.2)	42 (10.8)	72 (18.8)	144 (37.5)	110 (28.7)	3.76	1.12
9	Optimization of material consumption on production lines	20 (5.3)	72 (18.6)	114 (29.7)	116 (30.1)	62 (16.3)	3.33	1.13
10	Use of modern warehousing systems	27 (7.1)	94 (24.4)	114 (29.6)	94 (24.6)	55 (14.3)	3.14	1.18
11	Reduction of raw material waste in the production process	14 (3.8)	38 (9.8)	76 (19.9)	139 (36.2)	117 (30.3)	3.80	1.10
12	Accurate forecasting of raw material requirements	24 (6.4)	82 (21.5)	116 (30.2)	104 (27.1)	58 (14.8)	3.23	1.16

C. Items Related to Raw Material Cost-Management Challenges

No.	Item	1, n (%)	2, n (%)	3, n (%)	4, n (%)	5, n (%)	Mean	SD
13	Severe fluctuations in raw material prices	7 (1.8)	18 (4.8)	42 (10.9)	123 (32.1)	194 (50.4)	4.25	0.94
14	Weaknesses in cost-management information systems	10 (2.5)	27 (7.1)	60 (15.6)	132 (34.3)	155 (40.5)	4.04	1.03
15	Inefficiency in cost control	12 (3.1)	32 (8.3)	70 (18.2)	134 (34.9)	136 (35.5)	3.92	1.06
16	Raw material supply chain disruptions	8 (2.2)	22 (5.6)	44 (11.6)	121 (31.5)	189 (49.1)	4.20	0.95
17	Lack of specialized personnel in cost accounting	16 (4.1)	41 (10.7)	76 (19.9)	130 (33.8)	121 (31.5)	3.77	1.12
18	Lack of coordination among different organizational units	12 (3.3)	38 (9.8)	82 (21.4)	130 (33.9)	122 (31.6)	3.80	1.08

D. Items Related to Raw Material Cost Control and Optimization

No.	Item	1, n (%)	2, n (%)	3, n (%)	4, n (%)	5, n (%)	Mean	SD
19	Reduction in raw material costs during the past two years	20 (5.2)	63 (16.4)	106 (27.7)	124 (32.3)	71 (18.4)	3.42	1.15
20	Improved efficiency of raw material consumption	14 (3.5)	39 (10.1)	85 (22.3)	137 (35.7)	109 (28.4)	3.75	1.07
21	Increased accuracy in cost forecasting	14 (3.8)	48 (12.6)	94 (24.5)	139 (36.3)	89 (23.8)	3.62	1.08
22	Transparency of cost information within the organization	15 (3.9)	55 (14.3)	102 (26.6)	126 (32.9)	86 (22.3)	3.54	1.10
23	Positive effect of cost management on company profitability	11 (2.8)	31 (8.1)	69 (17.9)	132 (34.3)	141 (36.9)	3.89	1.06
24	Company’s ability to control costs under crisis conditions	13 (3.5)	46 (11.9)	91 (23.8)	132 (34.3)	102 (27.5)	3.68	1.08
25	Continuous improvement of cost-control systems	16 (4.1)	52 (13.4)	94 (24.6)	136 (35.4)	86 (22.5)	3.58	1.10

To identify the most important challenges and components of raw material cost management from the respondents’ perspective, the questionnaire items were ranked in descending order according to their mean scores. Table 3 presents this ranking.

Table 3

Ranking of Questionnaire Items Based on Mean Scores

Rank	Item	Mean	SD	Related Variable
1	Severe fluctuations in raw material prices (Item 13)	4.25	0.94	Challenges
2	Raw material supply chain disruptions (Item 16)	4.20	0.95	Challenges
3	Weaknesses in cost-management information systems (Item 14)	4.04	1.03	Challenges
4	Inefficiency in cost control (Item 15)	3.92	1.06	Challenges
5	Positive effect of cost management on company profitability (Item 23)	3.89	1.06	Control and optimization
6	Reduction of raw material waste in the production process (Item 11)	3.80	1.10	Inventory management
7	Lack of coordination among different organizational units (Item 18)	3.80	1.08	Challenges
8	Lack of specialized personnel in cost accounting (Item 17)	3.77	1.12	Challenges
9	Precise control of materials entering and leaving the warehouse (Item 8)	3.76	1.12	Inventory management
10	Improved efficiency of raw material consumption (Item 20)	3.75	1.07	Control and optimization
11	Company’s ability to control costs under crisis conditions (Item 24)	3.68	1.08	Control and optimization
12	Continuous control of raw material consumption on production lines (Item 5)	3.63	1.09	Cost-management practices
13	Increased accuracy in cost forecasting (Item 21)	3.62	1.08	Control and optimization
14	Continuous improvement of cost-control systems (Item 25)	3.58	1.10	Control and optimization
15	Transparency of cost information within the organization (Item 22)	3.54	1.10	Control and optimization
16	Precise planning for raw material procurement (Item 3)	3.51	1.11	Cost-management practices
17	Use of performance indicators to evaluate costs (Item 6)	3.44	1.12	Cost-management practices
18	Use of cost accounting systems in the company (Item 1)	3.42	1.14	Cost-management practices
19	Reduction in raw material costs during the past two years (Item 19)	3.42	1.15	Control and optimization
20	Use of modern cost-management methods (Item 4)	3.36	1.14	Cost-management practices
21	Optimization of material consumption on production lines (Item 9)	3.33	1.13	Inventory management
22	Regular analysis of raw material cost variances (Item 2)	3.22	1.14	Cost-management practices
23	Accurate forecasting of raw material requirements (Item 12)	3.23	1.16	Inventory management
24	Precise planning of raw material inventory (Item 7)	3.19	1.16	Inventory management
25	Use of modern warehousing systems (Item 10)	3.14	1.18	Inventory management

As shown in Table 3, among the 25 questionnaire items, the highest-ranked items, with mean scores approaching or exceeding 3.90, were predominantly related to raw material cost-management challenges. This result demonstrates the importance and severity of these challenges from the respondents’ perspective. In particular, “severe fluctuations in raw material prices,” with a mean score of 4.25, and “raw material supply chain disruptions,” with a mean score of 4.20, occupied the first and second ranks, respectively. These findings indicate that Iraqi industrial companies are highly affected by external factors and disruptions in global raw material markets.

In contrast, the lowest mean scores were related to raw material inventory and consumption management. The items “use of modern warehousing systems,” with a mean score of 3.14, and “precise planning of raw material inventory,” with a mean score of 3.19, occupied the lowest ranks. These results indicate serious weaknesses in the inventory-management infrastructure of Iraqi industrial companies.

The items related to raw material cost control and optimization had mean scores ranging from 3.42 to 3.89, indicating a relatively satisfactory condition that nevertheless requires further improvement.

Before conducting inferential statistical tests to examine the research hypotheses, it was necessary to assess the relevant statistical assumptions. These assumptions included normality of data distribution, linearity of relationships, absence of multicollinearity, independence of errors, and homogeneity of variances.

The Kolmogorov–Smirnov test was used to evaluate the normality of the distributions of the main research variables. Table 4 presents the results of this test.

Table 4

Results of the Kolmogorov–Smirnov Test for Assessing Data Normality

Variable	Z Statistic	Significance Level (p)	Status
Raw material cost-management practices	1.62	.011	Non-normal
Raw material inventory and consumption management	1.84	.002	Non-normal
Raw material cost-management challenges	1.75	.004	Non-normal
Raw material cost control and optimization	1.71	.006	Non-normal

As shown in Table 4, the significance levels of the Kolmogorov–Smirnov test for all research variables were below .05 (.011, .002, .004, and .006). Therefore, the null hypothesis that the data were normally distributed was rejected, indicating that none of the research variables followed a normal distribution. In other words, the data collected in this study did not conform to a normal distribution.

Given the non-normal distribution of the data, the nonparametric Spearman’s rank-order correlation test was used instead of the parametric Pearson’s correlation test to examine the relationships among the variables. Multiple linear regression analysis could still be used because it is relatively robust to violations of the normality assumption, particularly with a sample size of 384. Nevertheless, to increase statistical confidence, the variables were transformed using the natural logarithm transformation (Ln) before conducting the regression analysis to make their distributions more closely approximate normality.

An examination of the scatterplots showed that the relationship between each independent variable—raw material cost-management practices, raw material inventory and consumption management, and raw material cost-management challenges—and the dependent variable—raw material cost control and optimization—was relatively linear. The points in the scatterplots were distributed without pronounced curvilinear patterns or severe clustering, thereby supporting the assumption of linearity. In particular, raw material cost-management practices and raw material inventory management exhibited positive linear relationships with the dependent variable, whereas cost-management challenges exhibited a negative linear relationship.

To examine multicollinearity among the independent variables, the variance inflation factor (VIF) and tolerance indices were calculated. Table 5 presents the results.

Table 5

Multicollinearity Indices for the Independent Variables

Independent Variable	Tolerance	VIF
Raw material cost-management practices	0.58	1.72
Raw material inventory and consumption management	0.62	1.61
Raw material cost-management challenges	0.71	1.41

As shown in Table 5, the VIF values for all independent variables were below 10 (1.72, 1.61, and 1.41), and the tolerance values were above 0.10 (0.58, 0.62, and 0.71). Therefore, the assumption of no multicollinearity among the independent variables was supported, and multiple linear regression analysis could be used to examine their simultaneous effects on the dependent variable.

The Durbin–Watson test was used to assess the independence of errors in the regression model. The Durbin–Watson statistic for the research model was 1.94. Because this value was between 1.5 and 2.5, it indicated the absence of autocorrelation among the errors. In other words, the assumption of error independence was supported, and the regression residuals were independent of one another.

Levene’s test was used to examine the equality of error variances across different levels of the independent variables. Table 6 presents the results of this test.

Table 6

Results of Levene’s Test for Homogeneity of Variances

Variable	F Statistic	$df1$	$df2$	Significance Level (p)
Raw material cost-management practices	1.34	3	380	.262
Raw material inventory and consumption management	1.76	3	380	.155
Raw material cost-management challenges	2.21	3	380	.087

As shown in Table 6, the significance levels of Levene’s test for all variables were greater than .05 (.262, .155, and .087). Therefore, the null hypothesis of equal variances was not rejected, and the assumption of homogeneity of variances was supported. This result indicates that the error variances were equal across different groups of the independent variables and that linear regression analysis could be applied with an acceptable level of validity.

Based on the five research questions and their correlational and causal-predictive nature, the research hypotheses were formulated as one main hypothesis and three subsidiary hypotheses. In this section, the relationships among the variables were first examined, followed by an assessment of the effects of the independent variables on the dependent variable using multiple linear regression analysis.

Table 7

Spearman Correlation Matrix for the Research Variables

Variables	1	2	3	4
1. Raw material cost-management practices	1.000			
2. Raw material inventory and consumption management	.542**	1.000		
3. Raw material cost-management challenges	−.381**	−.426**	1.000	
4. Raw material cost control and optimization	.624**	.591**	−.533**	1.000

As shown in Table 7, the relationship between raw material cost-management practices and raw material cost control and optimization had a correlation coefficient of .624 and a significance level below .01, indicating a strong positive correlation between the two variables. In other words, the more effective and efficient the cost-management practices adopted by Iraqi industrial companies, the greater their ability to control and optimize raw material costs.

The relationship between raw material inventory and consumption management and raw material cost control and optimization had a correlation coefficient of .591 and a significance level below .01, indicating a relatively strong positive correlation between the two variables. This finding demonstrates that improved raw material inventory and consumption management is directly associated with improved cost control.

The relationship between raw material cost-management challenges and raw material cost control and optimization had a correlation coefficient of −.533 and a significance level below .01, indicating a relatively strong negative correlation between the two variables. In other words, as raw material cost-management challenges increase in Iraqi industrial companies, their ability to control and optimize raw material costs decreases.

The correlations among the independent variables were within acceptable limits. The correlation coefficient between the first and second independent variables was .542, the correlation between the first and third independent variables was −.381, and the correlation between the second and third independent variables was −.426. None of these values exceeded .80, indicating the absence of excessively strong correlations among the independent variables and further supporting the assumption of no multicollinearity.

Based on the findings presented in Table 7, the main research hypothesis proposing significant relationships between cost-management practices, inventory management, cost-management challenges, and raw material cost control in Iraqi industrial companies was supported.

Table 8

Summary of the Multiple Linear Regression Model

Model	R	R^2	Adjusted R^2	Standard Error of the Estimate	Durbin–Watson Statistic
1	.724	.524	.520	.446	1.94

As shown in Table 8, the multiple correlation coefficient (R) was .724, indicating a strong correlation between the combined independent variables and the dependent variable. The coefficient of determination (R^2) was .524, indicating that 52.4% of the variance in the dependent variable, raw material cost control and optimization, was explained by the three independent variables: raw material cost-management practices, raw material inventory and consumption management, and raw material cost-management challenges.

The adjusted R^2 was .520, which represents an acceptable value after accounting for the sample size and number of independent variables. The standard error of the estimate was .446, indicating that the model had relatively satisfactory predictive accuracy.

Table 9 presents the results of the analysis of variance (ANOVA) used to assess the overall significance of the regression model.

Table 9

Analysis of Variance for the Regression Model

Source	Sum of Squares (SS)	*df*	Mean Square (MS)	*F*	Significance Level (*p*)
Regression	31.67	3	10.56	139.48	< .001
Residual	34.50	380	0.09	—	—
Total	66.17	383	—	—	—

As shown in Table 9, the *F* statistic was 139.48, with a significance level below .001, which was less than .05. Therefore, the regression model was statistically significant at the 95% confidence level, indicating that at least one of the independent variables had a statistically significant effect on the dependent variable. This finding supported the main research hypothesis proposing that cost-management practices, inventory management, and cost-management challenges affect raw material cost control.

Table 10

Multiple Linear Regression Coefficients

Variable	Unstandardized Coefficient (*B*)	Standard Error	Standardized Coefficient (β)	*t*	Significance Level (*p*)	Result
Constant	0.24	0.14	—	1.71	.089	—
Raw material cost-management practices	0.36	0.05	.34	7.32	< .001	Supported
Raw material inventory and consumption management	0.27	0.04	.29	6.75	< .001	Supported
Raw material cost-management challenges	−0.26	0.05	−.22	−5.20	< .001	Supported

As shown in Table 10, the standardized coefficient (β) for raw material cost-management practices was .34, indicating a positive effect of this variable on cost control. The *t* statistic was 7.32, and the significance level was below .001, which was less than .05. Therefore, the first subsidiary hypothesis was supported, demonstrating that raw material cost-management practices have a positive and statistically significant effect on raw material cost control and optimization in Iraqi industrial companies.

In other words, a one-standard-deviation improvement in raw material cost-management practices was associated with a .34-standard-deviation increase in raw material cost control and optimization.

The standardized coefficient (β) for raw material inventory and consumption management was .29, indicating a positive effect of this variable on cost control. The *t* statistic was 6.75, and the significance level was below .001, which was less than .05. Therefore, the second subsidiary hypothesis was supported, indicating that raw material inventory and consumption management has a positive and statistically significant effect on raw material cost control and optimization in Iraqi industrial companies.

In other words, a one-standard-deviation improvement in raw material inventory and consumption management was associated with a .29-standard-deviation increase in raw material cost control and optimization.

The standardized coefficient (β) for raw material cost-management challenges was −.22, indicating a negative effect of this variable on cost control. The *t* statistic was −5.20, and the significance level was below .001, which was less than .05. Therefore, the third subsidiary hypothesis was supported, indicating that raw material cost-management challenges have a negative and statistically significant effect on raw material cost control and optimization in Iraqi industrial companies.

In other words, a one-standard-deviation increase in raw material cost-management challenges was associated with a .22-standard-deviation decrease in raw material cost control and optimization.

Based on the standardized coefficients, raw material cost-management practices had the strongest effect on raw material cost control and optimization, with a coefficient of .34. Raw material inventory and consumption management ranked second, with a coefficient of .29, whereas raw material cost-management challenges ranked third, with a coefficient of −.22.

Discussion and Conclusion

The present study investigated raw material cost-management practices and examined the effects of cost-management practices, raw material inventory and consumption management, and raw material cost-management challenges on cost control and optimization in Iraqi industrial companies. The descriptive findings showed that raw material cost-management challenges received the highest mean score among the study variables, whereas raw material inventory and consumption management received the lowest mean score. At the item level, severe fluctuations in raw material prices and raw material supply chain disruptions were identified as the most prominent challenges. The inferential findings demonstrated that raw material cost-management practices and inventory and consumption management were positively and significantly associated with cost control and optimization. In contrast, raw material cost-management challenges had a negative and significant relationship with cost control and optimization. The regression model explained 52.4% of the variance in raw material cost control and optimization, indicating that the three independent variables collectively had substantial explanatory power. Among them, raw material cost-management practices exerted the strongest standardized effect, followed by raw material inventory and consumption management, whereas cost-management challenges had a significant negative effect.

The first notable finding was that raw material cost-management challenges were perceived to be at a high level in Iraqi industrial companies. This result suggests that companies operate in an environment in which cost control is affected by both external market pressures and internal organizational weaknesses. The two highest-ranked challenges were fluctuations in raw material prices and disruptions in the supply chain. Price instability can make budgeting, standard costing, procurement planning, and product pricing difficult because the actual cost of inputs may deviate considerably from planned values. Under such conditions, traditional annual or fixed-period purchasing plans may become rapidly outdated. This interpretation is consistent with research emphasizing the importance of data-driven procurement strategies under uncertainty in raw material prices and production demand. Such strategies enable firms to adjust purchasing quantities, procurement timing, and supplier selection according to changing market information rather than relying on static plans [16]. The finding also aligns with the view that flexible business strategies are essential in manufacturing supply chains because firms must continuously adapt sourcing, production, and inventory decisions to environmental uncertainty [17].

The prominence of supply chain disruptions as a major challenge is also consistent with previous research showing that disruptions can increase procurement costs, delay production, create inventory shortages, and force companies to rely on more expensive emergency purchasing arrangements. Effective disruption mitigation requires supplier diversification, information sharing, flexible sourcing arrangements, contingency inventory, and responsive logistics systems [18]. The findings of the present study suggest that Iraqi industrial companies may not yet possess sufficient resilience to absorb or respond efficiently to interruptions in material supply. This result also corresponds with sustainable smart supply chain frameworks that emphasize the integration of resilience, digitalization, and coordination as prerequisites for managing uncertainty [19]. The relatively high challenge scores may therefore reflect both the severity of external shocks and the limited adaptive capacity of the companies under investigation.

Weak cost-management information systems were ranked as another important challenge. This finding indicates that many companies may experience difficulties in generating timely, integrated, and accurate data on procurement prices, warehouse balances, material consumption, waste, and production costs. Digital transformation can substantially improve cost management by linking operational data with accounting information and enabling real-time analysis of cost behavior [12]. Digital inventory technologies can similarly improve traceability, stock accuracy, demand forecasting, and automated monitoring [11]. Therefore, the high score assigned to weaknesses in information systems may indicate that the potential benefits of digital cost and inventory management have not been fully realized in the studied companies.

The findings further showed that raw material inventory and consumption management had the lowest mean score among the main variables. The lowest-ranked items were the use of modern warehousing systems and precise raw material inventory planning. These results point to weaknesses in stock visibility, material requirement forecasting, warehouse automation, and alignment between procurement and production. Inadequate inventory planning can generate both shortages and excessive stock. Shortages interrupt production and encourage emergency purchases, whereas excessive inventory increases storage, financing, deterioration, and obsolescence costs. Previous research has shown that material requirements planning can improve the timing and quantity of purchases by integrating production schedules, inventory records, bills of materials, and lead times [10]. The comparatively low inventory-management scores found in this study may therefore reflect limited use of integrated planning methods and insufficient coordination among procurement, production, and warehouse functions.

The low score related to modern warehousing systems is also important because effective inventory control increasingly depends on digital technologies. Internet of Things devices, barcode systems, radio-frequency identification, enterprise resource planning platforms, and automated warehouse records can provide real-time information about the quantity, location, movement, and condition of raw materials. The combined use of the Internet of Things and blockchain technology can improve visibility, traceability, accountability, and trust across supply chain operations [13]. Blockchain may also enhance data integrity and transparency among suppliers and manufacturing organizations [14]. However, technological adoption may be constrained by infrastructure, implementation costs, staff expertise, system interoperability, and organizational readiness. These barriers are consistent with the challenges identified in studies of blockchain adoption in supply chain management [15]. Consequently, the low level of modern warehousing practices observed in the present study may not simply reflect managerial neglect but may also be related to technological and institutional constraints.

The correlation and regression analyses demonstrated that raw material cost-management practices had the strongest positive effect on cost control and optimization. This finding indicates that companies that apply systematic cost-accounting procedures, analyze material cost variances, plan procurement carefully, monitor material consumption, employ performance indicators, and use modern cost-management methods are more successful in controlling raw material costs. This result is consistent with the principles of strategic cost management, which emphasize the identification of cost drivers, reduction of non-value-adding activities, and integration of cost information with strategic and operational decisions [4]. It also supports empirical evidence showing that cost-reduction strategies can improve manufacturing performance when they are supported by accurate accounting information and structured managerial controls [5].

The strong effect of cost-management practices can also be explained by the ability of accounting systems to make inefficiencies visible. When raw material consumption is continuously monitored and cost deviations are regularly analyzed, managers can identify abnormal usage, purchase-price variances, waste, and operational losses before they become persistent. Material flow cost accounting is particularly relevant in this regard because it assigns monetary values to both productive outputs and material losses. This enables management to recognize that waste absorbs material, energy, labor, and processing costs rather than representing only a physical loss [6]. Evidence from manufacturing applications similarly shows that material flow cost accounting can integrate economic and environmental objectives and support sustainability-oriented decision-making [7].

The positive effect of cost-management practices is further supported by research showing that material flow cost accounting can enhance cost transparency, increase organizational awareness of resource inefficiencies, and direct managerial attention toward process improvement [9]. The application of this approach is especially important when production processes involve rework, defective output, and variations in raw material quality. Low-quality materials may reduce purchasing expenditure but increase reprocessing, waste, downtime, and inspection costs. Research has demonstrated that material flow cost accounting can support the optimization of raw material quality by balancing acquisition costs against rework and material-loss costs [8]. Therefore, the significant positive role of cost-management practices found in this study may be explained by their capacity to produce more complete information about the actual economic consequences of material use.

Raw material inventory and consumption management also had a positive and statistically significant effect on cost control and optimization. This result indicates that accurate stock planning, warehouse control, material-consumption optimization, waste reduction, and forecasting of raw material requirements contribute directly to cost performance. Effective inventory management reduces the probability of emergency procurement, production stoppages, excess storage, material deterioration, and unnecessary working-capital commitments. The result is consistent with research on raw materials management in industrial firms, which emphasizes the importance of coordinating procurement, storage, production, and quality decisions [1]. It also corresponds with studies demonstrating the value of systematic material planning for maintaining production continuity and controlling material-related costs [2].

The positive effect of inventory management may also be interpreted through the principles of lean manufacturing. Lean practices seek to reduce excess inventory, defects, waiting time, overproduction, and inefficient material movement. By reducing non-value-adding activities, lean systems can lower raw material costs and improve operational and sustainability performance [21]. The benefits may be stronger when lean practices are combined with innovativeness, because innovative companies are better able to redesign processes and adopt new inventory technologies [22]. The findings of this study therefore suggest that improvements in inventory management should not be limited to stricter warehouse control but should involve broader process improvement and technological modernization.

The negative effect of raw material cost-management challenges on cost control and optimization was another central finding. As price fluctuations, information-system weaknesses, cost-control inefficiencies, supply chain disruptions, skills shortages, and interdepartmental coordination problems increased, the ability of companies to control costs declined. This result is theoretically expected because such challenges create uncertainty, reduce information quality, delay decisions, and weaken operational coordination. The finding concerning interdepartmental coordination is consistent with research indicating that organizational culture and internal relationships significantly affect supply chain performance [20]. Cost control depends on cooperation among accounting, procurement, production, warehousing, and senior management; when these functions pursue conflicting objectives or fail to share information, total material costs may increase even when each department appears to meet its own targets.

The negative effect of challenges can also be explained by limitations in human and organizational capabilities. The lack of specialized personnel in cost accounting was rated as a relatively important issue. Effective cost management requires expertise in costing methods, variance analysis, performance measurement, inventory systems, and strategic decision support. Technological systems alone cannot improve cost control if employees lack the ability to interpret information or integrate it into managerial decisions. The development of green and operational capabilities has been linked to improved organizational performance because capabilities determine whether firms can translate resources and technologies into effective practices [25]. Similarly, sustainability innovation frameworks emphasize organizational learning, supplier collaboration, performance measurement, and managerial competence [26].

The overall explanatory power of the model was substantial, with cost-management practices, inventory management, and challenges accounting for 52.4% of the variance in raw material cost control and optimization. This indicates that cost performance is not determined by a single accounting procedure but by the interaction of managerial practices, operational systems, and contextual constraints. The unexplained variance may be related to other factors, including firm size, industry type, technology level, exchange-rate exposure, supplier concentration, production complexity, managerial experience, and government policies. Sustainable manufacturing assessment frameworks similarly show that organizational performance is multidimensional and cannot be explained by isolated indicators [24]. The use of process-specific key performance indicators may therefore enable firms to better understand variations in material efficiency and cost outcomes [3].

The findings also have implications for sustainability. Improved raw material cost management can reduce both financial expenditure and environmental losses. Efficient material use decreases waste, energy consumption, disposal requirements, and pressure on natural resources. Sustainable consumption and production frameworks emphasize the need to integrate resource efficiency with economic performance [23]. Industrial symbiosis may offer an additional opportunity by allowing by-products and waste from one firm to be used as inputs by another, although such arrangements require effective accounting for transaction and coordination costs [27]. Therefore, strengthening raw material cost accounting in Iraqi industrial companies may support not only profitability but also broader sustainable industrial development.

This study had several limitations. First, the data were collected through self-report questionnaires, and the responses may have been affected by social desirability, individual perceptions, or incomplete knowledge of company-wide practices. Second, the cross-sectional design limited the ability to establish definitive causal relationships or examine changes in cost-management performance over time. Third, the statistical population was treated as unlimited because the exact number of eligible professionals in Iraqi industrial companies was unavailable, which may have restricted the precision of the sampling frame. Fourth, the study included companies from different industrial sectors, but sector-specific differences were not examined separately. Finally, objective accounting data, such as actual material waste, inventory turnover, purchase-price variances, and raw material cost ratios, were not used to validate the questionnaire findings.

Future studies should employ longitudinal designs to investigate how improvements in cost accounting and inventory-management systems affect raw material costs over time. Researchers should combine questionnaire data with objective financial and operational indicators to increase the validity of the findings. Comparative studies across industrial sectors, company sizes, ownership structures, and geographical regions of Iraq could identify contextual differences in cost-management performance. Future research could also examine the mediating or moderating roles of digital transformation, organizational culture, employee expertise, supply chain resilience, and environmental management. Experimental or case-study research should evaluate the effects of implementing enterprise resource planning, material requirements planning, material flow cost accounting, and automated warehouse systems in selected industrial companies.

Managers of Iraqi industrial companies should modernize cost-accounting and inventory systems by integrating procurement, warehousing, production, and accounting information. Companies should regularly analyze purchase-price, consumption, and material-usage variances and develop clear performance indicators for waste, inventory turnover, supplier reliability, and production efficiency. Supplier diversification, contingency planning, and flexible purchasing contracts should be used to reduce exposure to price volatility and supply disruptions. Investment in modern warehousing technologies and staff training should be prioritized, particularly in cost accounting, inventory forecasting, and digital systems. Cross-functional cost-management teams should also be established to improve coordination among financial, procurement, production, and warehouse units and ensure that raw material cost reduction is pursued without compromising quality or production continuity.

Acknowledgments

We would like to express our appreciation and gratitude to all those who cooperated in carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

References

[1] H. Florén, J. Frishammar, A. Löf, and M. Ericsson, "Raw Materials Management in Iron- and Steelmaking Firms," (in English), *Mineral Economics,* vol. 32, no. 1, pp. 39-47, 2019, doi: 10.1007/s13563-018-0158-7.

[2] D. N. Lapaev and I. E. Mizikovsky, "Improving the Planning and Accounting of Material Costs for the Repair and Maintenance Needs of an Industrial Enterprise," (in English), *Vestnik of Samara University: Economics and Management,* vol. 15, no. 2, pp. 77-89, 2024, doi: 10.18287/2542-0461-2024-15-2-77-89.

[3] M. Glišić, B. Veluri, and D. Ramanujan, "A Bottom-Up Methodology for Identifying Key Performance Indicators for Sustainability Monitoring of Unit Manufacturing Processes," (in English), *Sustainability,* vol. 16, no. 2, p. 806, 2024, doi: 10.3390/su16020806.

[4] M. M. Rounaghi, H. Jarrar, and L. P. Dana, "Implementation of Strategic Cost Management in Manufacturing Companies: Overcoming Cost Stickiness and Increasing Corporate Sustainability," (in English), *Future Business Journal,* vol. 7, no. 31, pp. 1-17, 2021, doi: 10.1186/s43093-021-00079-4.

[5] R. A. Fadjarenie, C. Rachmadani, and D. Tarmidi, "Cost Reduction Strategy in Manufacturing Industries: Empirical Evidence from Indonesia," (in English), *Jurnal Akuntansi,* vol. 28, no. 1, pp. 1-18, 2024, doi: 10.24912/ja.v28i1.1747.

[6] K. Kokubu, H. Kitada, K. Nishitani, and A. Shinohara, "How Material Flow Cost Accounting Contributes to the Sustainable Development Goals through Improved Management Decision-Making," (in English), *Journal of Material Cycles and Waste Management,* vol. 25, no. 5, pp. 2783-2793, 2023, doi: 10.1007/s10163-023-01696-7.

[7] R. D. Fatah and R. A. S. Jaf, "Green Concepts and Material Flow Cost Accounting Applications for a Manufacturing Company: An Approach to Corporate Sustainability," (in English), *Russian Law Journal,* vol. 11, no. 9S, pp. 110-123, 2023, doi: 10.52783/rlj.v11i9s.1803.

[8] M. Seifbarghy, M. Hamidi, and W. Chattinnawat, "Optimizing the Quality Level of Raw Materials Based on Material Flow Cost Accounting in a Production System with Rework," (in English), *The Engineering Economist,* vol. 67, no. 4, pp. 288-305, 2022, doi: 10.1080/0013791X.2022.2121883.

[9] M. Walz and E. Guenther, "What Effects Does Material Flow Cost Accounting Have for Companies? Evidence from a Case-Study Analysis," (in English), *Journal of Industrial Ecology,* vol. 25, no. 3, pp. 593-613, 2021, doi: 10.1111/jiec.13064.

[10] J. Chavez Medina, N. A. Santiesteban López, and V. G. Luna Fernández, "Methodological Development of the Supply of Materials Using MRP: The Case of an Automotive-Sector Supplier," (in English), *Estudios de Administración,* vol. 27, no. 2, pp. 1-21, 2020, doi: 10.5354/0719-0816.2020.58231.

[11] S. Y. Barykin, O. V. Kalinina, I. V. Kapustina, Y. A. Dubolazova, and C. A. Esquivel, "Digital Technologies for Inventory Management," (in English), *Sustainability,* vol. 13, no. 4, p. 1945, 2021, doi: 10.3390/su13169289.

[12] C. Liu, P. Jiang, and W. Jiang, "Digital Transformation and Cost Management in Manufacturing Enterprises," (in English), *Sustainability,* vol. 14, no. 8, p. 4673, 2022.

[13] A. Rejeb, J. G. Keogh, and H. Treiblmaier, "Leveraging the Internet of Things and Blockchain Technology," (in English), *Future Internet,* vol. 13, no. 2, p. 50, 2021, doi: 10.1016/j.iot.2021.100361.

[14] M. Kouhizadeh, S. Saberi, and J. Sarkis, "Blockchain Technology and the Sustainable Supply Chain," (in English), *International Journal of Production Research,* vol. 59, no. 7, pp. 2110-2135, 2021.

[15] M. M. Queiroz and S. F. Wamba, "Blockchain Adoption Challenges in Supply Chain Management," (in English), *International Journal of Information Management,* vol. 52, p. 101967, 2019, doi: 10.1016/j.ijinfomgt.2018.11.021.

[16] X. Wang, Y. Zhang, J. Li, and H. Chen, "Data-Driven Optimization Strategy for Raw-Material Procurement under Uncertainty in Price Fluctuations and Production Demand," (in English), *Computers & Industrial Engineering,* vol. 208, p. 111425, 2025, doi: 10.1016/j.cie.2025.111425.

[17] R. Rajesh, "Flexible Business Strategies in Manufacturing Supply Chains," (in English), *International Journal of Production Economics,* vol. 227, p. 107688, 2020.

[18] A. Kumar, S. K. Mangla, P. Kumar, and M. Song, "Mitigating Supply Chain Disruptions," (in English), *Transportation Research Part E: Logistics and Transportation Review,* vol. 147, p. 102214, 2021.

[19] G. Yadav, S. K. Mangla, S. Luthra, and D. P. Rai, "Developing a Sustainable Smart Supply Chain Framework," (in English), *Benchmarking: An International Journal*, vol. 27, no. 7, pp. 2339-2362, 2020.

[20] T. Cadden, D. Marshall, and G. Cao, "Opposites Attract: Organisational Culture and Supply Chain Performance," (in English), *Supply Chain Management*, vol. 25, no. 1, pp. 86-103, 2020, doi: 10.1108/13598541311293203.

[21] R. Henao, W. Sarache, and I. Gómez, "Lean Manufacturing and Sustainable Performance," (in English), *Journal of Cleaner Production*, vol. 208, pp. 99-110, 2019, doi: 10.1016/j.jclepro.2018.10.116.

[22] Shashi, P. Centobelli, R. Cerchione, and R. Singh, "The Impact of Leanness and Innovativeness," (in English), *Business Strategy and the Environment*, vol. 29, no. 1, pp. 1-15, 2020.

[23] M. L. Tseng, A. S. F. Chiu, R. R. Tan, and A. B. Siriban-Manalang, "Sustainable Consumption and Production," (in English), *Journal of Cleaner Production*, vol. 213, pp. 1-10, 2019.

[24] J. Lee and E. Kazakova, "Can Companies Assess Sustainable Manufacturing Practice?," (in English), *Sustainability*, vol. 16, no. 12, p. 5259, 2024, doi: 10.3390/su16125259.

[25] S. A. R. Khan, Z. Yu, and A. Sharif, "Green Capabilities and Organizational Performance," (in English), *Journal of Cleaner Production*, vol. 278, p. 123872, 2021.

[26] S. Kusi-Sarpong, H. Gupta, and J. Sarkis, "A Supply Chain Sustainability Innovation Framework," (in English), *International Journal of Production Research*, vol. 57, no. 7, pp. 1990-2008, 2019, doi: 10.1080/00207543.2018.1518607.

[27] V. Yazdanpanah, D. M. Yazan, and W. H. M. Zijm, "Dynamics and Allocation of Transaction Costs in Multiagent Industrial Symbiosis," (in English), *Computers & Industrial Engineering*, vol. 151, p. 106968, 2020.