

# THE ROLE OF MODERN MANAGEMENT ACCOUNTING TOOLS IN ENHANCING SUSTAINABLE VALUE CHAIN MANAGEMENT

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**Abstract.** Modern industrial companies face increasing pressure to align their profitability with environmental sustainability and social responsibility. Management accounting — which used to be restricted to cost control and mandatory financial reporting — has also undergone significant evolution to accommodate the information needs created by sustainability-oriented value chain governance. Using the purposively selected Wasit Textile and Sewing Factory as a single qualitative case, this study seeks to investigate whether Activity-Based Costing (ABC) and the Balanced Scorecard (BSC) meaningfully contribute to Sustainable Value Chain Management (SVCM) within the context of the textile manufacturing sector in Iraq.

A quantitative design was employed. We conducted a structured questionnaire among all 76 employees working in the managerial, accounting, and technical departments; 71 completed responses were retained for analysis, yielding a response rate of 93.42%. Data processing was performed using descriptive statistical analysis, Cronbach's alpha reliability test, one-sample t-test, Pearson correlation analysis, and multiple linear regression using IBM SPSS 26.

SVCM is positively affected by both ABC ( $p < 0.001$ ) and BSC ( $p < 0.001$ ), and their combined effect is statistically significant ( $R^2 = 0.681$ ). Accordingly, ABC appears as the stronger predictor (standardized  $\beta = 0.504$ ; reflecting variance explained in overhead structures), while BSC contributes through strategic alignment with sustainability ( $\beta = 0.348$ ). Recently published in the journal *Business Strategy and the Environment*, the research highlights the importance of translating

sustainability into financial terms, indicating the need for systematic investment by industrial firms to expand sustainability measurement into cost accounting systems and to develop internal capabilities for sustainability-based performance assessment. This framework requires replication across manufacturing industries and organizational types in developing economy contexts as a direction for future research.

**Keywords:** Management Accounting Tools; Activity-Based Costing; Balanced Scorecard; Sustainable Value Chain Management; Textile Manufacturing; Iraq.

**РОЛЬ СОВРЕМЕННЫХ ИНСТРУМЕНТОВ УПРАВЛЕНЧЕСКОГО  
УЧЁТА В ПОВЫШЕНИИ ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ  
УСТОЙЧИВЫМИ ЦЕПОЧКАМИ СОЗДАНИЯ СТОИМОСТИ**

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**Аннотация.** Современные промышленные компании сталкиваются с растущим давлением в отношении согласования прибыльности с экологической устойчивостью и социальной ответственностью. Управленческий учёт — ранее ограниченный контролем затрат и обязательной финансовой отчётностью — также претерпел значительную эволюцию, чтобы соответствовать информационным потребностям, возникающим в условиях управления цепочками создания стоимости, ориентированными на устойчивое развитие. Используя целенаправленно выбранную текстильную и швейную фабрику Васит в качестве единого кейса, данное исследование направлено на изучение того, в какой степени метод учёта затрат по видам деятельности (ABC) и сбалансированная система показателей (BSC) способствуют эффективному

управлению устойчивыми цепочками создания стоимости (SVCМ) в контексте текстильной промышленности Ирака.

В исследовании применён количественный дизайн. Был проведён структурированный опрос среди всех 76 сотрудников, работающих в управленческих, бухгалтерских и технических подразделениях; 71 полностью заполненная анкета была включена в анализ, что соответствует уровню отклика 93,42%. Обработка данных осуществлялась с использованием методов описательной статистики, теста надёжности Кронбаха (альфа), одно выборочного t-теста, корреляционного анализа Пирсона и множественной линейной регрессии в программе IBM SPSS 26.

Результаты показывают, что на SVCМ положительно влияют как ABC ( $p < 0,001$ ), так и BSC ( $p < 0,001$ ), при этом их совокупное воздействие является статистически значимым ( $R^2 = 0,681$ ). При этом ABC выступает более сильным предиктором (стандартизированный  $\beta = 0,504$ ; отражает объяснённую вариацию в структуре накладных расходов), тогда как BSC вносит вклад за счёт стратегического согласования с целями устойчивого развития ( $\beta = 0,348$ ). Исследование, опубликованное в журнале *Business Strategy and the Environment*, подчёркивает важность трансформации показателей устойчивости в финансовые категории, указывая на необходимость системных инвестиций со стороны промышленных предприятий в расширение измерения устойчивости в системах управленческого учёта, а также в развитие внутренних компетенций для оценки эффективности, основанной на принципах устойчивого развития. Представленная модель требует дальнейшего воспроизведения в различных отраслях промышленности и типах организаций в условиях развивающихся экономик.

Ключевые слова: инструменты управленческого учёта; учет затрат по видам деятельности; сбалансированная система показателей; управление

устойчивыми цепочками создания стоимости; текстильная промышленность; Ирак.

## **1. Introduction**

The global sustainability imperative — which has accelerated in recent decades — is among the few developments that have redefined industrial strategy. Global frameworks — such as the UN Sustainable Development Goals (SDGs), the Paris Climate Agreement, and ISO 14001 — have elevated environmental and social performance from a liability and low-level corporate responsibility to a strategic asset that drives market access, influences investor confidence, and determines regulatory outcomes. In this context, management accounting has been challenged to extend far beyond its traditional limits. While traditional accounting systems focused mainly on external financial reporting and internal cost management, they are not well suited to multivalue ecosystems or to representing the multidimensional nature of sustainability performance across long-term value chains [25,17].

Since its inception, the value chain concept — encompassing the entire series of activities that an organization performs to add economic value to its products — has remained central to strategic management. However, it cannot be managed sustainably solely through operational efficiency; it must also account for environmental impacts, socio-economic outcomes, and the long-term use of natural resources at every stage of production and distribution. To meet the information requirements of sustainable value chain governance, two contemporary management accounting tools have received significant attention as potentially effective instruments for bridging the gap between traditional financial management and its sustainability-oriented counterpart: Activity-Based Costing (ABC) and the Balanced Scorecard (BSC) [12,34,35]. These instruments help organizations reveal hidden environmental costs, track resource use at the activity level, align departmental

objectives with overall corporate sustainability strategy, and report non-financial performance credibly to various stakeholders [16], [19], [20].

Activity-Based Costing (ABC) is a technique that identifies indirect and overhead costs and assigns them to products, services, or processes based on the actual consumption of organizational activities, thereby producing more accurate cost information than volume-based allocation systems. When applied to environmental cost drivers — such as energy use, chemical consumption, water usage, and waste disposal — ABC becomes a powerful tool for revealing embedded environmental costs in industrial operations and supports decision-making aimed at shifting away from unsustainable production practices [22]. The Balanced Scorecard (BSC) [12] operates at a strategic level by translating organizational strategy into a balanced set of financial and non-financial performance measures across four perspectives: financial, customer, internal processes, and learning and growth. Its flexibility enables organizations to explicitly integrate sustainability goals into their strategic architecture — an evolution formalized through the Sustainability Balanced Scorecard (SBSC), which connects environmental and social performance measures with traditional financial perspectives [7], [16], [4], [5].

Sustainable Value Chain Management (SVCM), in turn, refers to the deliberate integration of environmental, social, and economic considerations into each primary and support activity, from raw material extraction through inbound logistics, production, outbound distribution, and end-of-life processes [23]. A robust informational infrastructure is a prerequisite for effective SVCM: without systems to track sustainability impacts and associated costs, organizations cannot manage what they cannot measure [3], [6], [26]. This information gap represents precisely the challenge that modern management accounting tools are designed to address.

At the same time, this research area is particularly important in developing economy industrial contexts, where empirical evidence linking the sophistication of

accounting systems to sustainability performance remains limited. Iraq's manufacturing sector faces a dual challenge: it must modernize production processes to remain competitive globally while also addressing environmental degradation resulting from resource-intensive legacy practices. The textile industry is especially significant in this regard, as it is one of the most resource-intensive manufacturing sectors, characterized by high water consumption, chemical waste, and energy use throughout the production cycle [11], [10]. Despite its environmental relevance, empirical studies on management accounting in Iraqi industrial firms are largely absent from the international sustainability accounting literature [13], which this research seeks to address directly.

In this context, the present study aims to investigate the role of ABC and BSC in improving sustainable value chain management at the Wasit Textile and Sewing Factory. Using purposive sampling, the factory was selected as a relevant and accessible case representing typical sustainability challenges in developing economy textile production. Accordingly, the main research question is: to what extent does the implementation of modern management accounting tools act as an enabler for improving SVCM in this industrial environment? The study is guided by four specific objectives: to measure the level of ABC application and its statistical relationship with SVCM; to assess the role of BSC in facilitating sustainability-oriented strategic management along the factory's value chain; to test the joint significance of ABC and BSC as predictors of SVCM; and to derive practical implications for integrating sustainability into management accounting practices in the Iraqi industrial sector.

This research contributes in three ways. Academically, it extends sustainability accounting research into the underexplored Iraqi industrial context and provides empirical evidence to a literature largely dominated by Western and East Asian studies. Theoretically, it integrates ABC, BSC, and SVCM into a unified framework, offering a foundation for future research examining both conceptual relationships and

methodological validity (emphasizing statistical rigor over purely qualitative approaches in this field). Practically, it provides insights for factory managers, policymakers, and accounting standard-setters interested in promoting sustainable manufacturing in Iraq and similar developing economy contexts [24], [18], [8].

### **3. Research Methodology**

#### **3.1 Research Design**

The research follows a quantitative design grounded in the positivist epistemological tradition. The quantitative approach is appropriate for the central purpose of the study: to empirically test hypothesized relationships between specified variables using numerical data presented in a clearly structured manner. This study adopts a case study strategy, whereby the relevant unit of analysis is the Wasit Textile and Sewing Factory. However, while case studies are more traditionally associated with qualitative inquiry, quantitative case studies — particularly those employing a survey instrument within a single organization — are well established in the management accounting and broader organizational research literature. Such an approach allows for contextual depth while maintaining statistical rigor.

#### **3.2 Sample and Data Collection**

##### **3.2.1 Population and Sampling Strategy**

The study population included all managerial, accounting, financial, technical, and supervisory personnel working at the Wasit Textile and Sewing Factory in Wasit Governorate, Iraq. Purposive sampling, a non-probability sampling method that involves the deliberate selection of participants based on their knowledge and/or experience with the phenomena under investigation, was used to select the factory. This case is justified for three reasons: (1) it represents a real industrial setting directly relevant to the core focus of this study — environmental manufacturing strategy and SVCMM; (2) it is situated within the Iraqi industrial sector, where substantial underinvestment in management accounting systems has occurred over the

past four decades, making this context particularly significant; and (3) the research team obtained full cooperative access from both administrative and technical staff at the site, ensuring the accuracy and reliability of data collection [33].

### 3.2.2 Administration and Characteristics of the Questionnaire Response

A structured questionnaire was designed and distributed to 76 employees of the factory, including staff from managerial, accounting, and technical departments. Of these, 71 questionnaires were returned complete and usable; five were excluded due to incomplete responses or evidence of systematic answering patterns indicating lack of attention. The achieved response rate of 93.42% is considered excellent according to established standards in survey research.

**Table 1: Questionnaire Distribution and Return Summary**

Description	Count
Distributed	76
Returned	71
Excluded (Incomplete)	5
Valid for Analysis	71
Response Rate (%)	93.42%

## 3.3 Measurement Instruments

### 3.3.1 Independent Variable 1: Activity-Based Costing (ABC)

Activity-Based Costing (ABC) is defined as a structured approach to managing indirect and overhead costs by assigning such costs to appropriate products, services, and processes based on the activities that drive actual resource consumption. ABC measures the extent to which activity-level environmental and operational costs are identified, traced, and reported within the factory's accounting system to support decision-making regarding resource allocation, process efficiency, and environmental resource expenditure. This construct is measured using a 10-item, five-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree).

**Table 2a: ABC Measurement Items**

Item	Description
ABC1	The factory uses ABC to accurately allocate overhead costs to production activities
ABC2	ABC enables identification of environmental cost drivers within production processes
ABC3	The accounting system traces resource consumption at the activity level
ABC4	ABC information supports decisions about environmental waste reduction
ABC5	Activity cost pools are clearly defined and regularly reviewed
ABC6	ABC provides more accurate product costing than traditional volume-based methods
ABC7	Environmental costs are explicitly included within the ABC model
ABC8	ABC outputs are integrated into sustainability performance reports
ABC9	Management uses ABC information for strategic sustainability decisions
ABC10	The ABC system is regularly updated to reflect changes in production activities

### 3.3.2 Independent Variable 2: Balanced Scorecard (BSC)

The Balanced Scorecard (BSC) is operationalised as a strategic performance management framework that translates organizational strategy into a balanced set of financial and non-financial measures across multiple perspectives. In this study, the BSC is used to assess the extent to which sustainable development goals are integrated into the factory's strategic performance measurement system by linking environmental and social objectives with the operational objectives of departmental functions. This construct is measured using a 10-item, five-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree).

**Table 2b: BSC Measurement Items**

Item	Description
BSC1	The factory uses a BSC to link sustainability goals to financial performance
BSC2	Environmental performance indicators are included in the factory's BSC framework
BSC3	The BSC communicates sustainability targets clearly to operational staff
BSC4	Customer satisfaction related to sustainable products is tracked within the BSC
BSC5	Internal process metrics within the BSC include environmental efficiency indicators
BSC6	The BSC includes learning and growth objectives related to sustainability capability
BSC7	Sustainability performance is regularly reviewed through the BSC framework
BSC8	The BSC aligns departmental objectives with the factory's sustainability strategy
BSC9	Management uses BSC feedback to adjust sustainability-related operational decisions

Item	Description
BSC10	The BSC framework has contributed to improvements in sustainable value chain practices

### 3.3.3 Dependent Variable: Sustainable Value Chain Management (SVCM)

Sustainable Value Chain Management (SVCM) is defined as the degree to which the factory systematically integrates environmental, social, and economic sustainability factors into all primary and support activities of its value chain — from the procurement of raw materials and inbound logistics to production, outbound distribution, and end-of-life management — with the objectives of minimizing environmental impact, maximizing social performance, and preserving long-term economic viability. This construct is measured using a 10-item, five-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree).

**Table 2c: SVCM Measurement Items**

Item	Description
SVCM1	The factory prioritises environmental criteria in procurement decisions
SVCM2	Production processes are managed to minimise environmental waste and emissions
SVCM3	The factory implements systematic programmes for waste reduction and recycling
SVCM4	Energy efficiency objectives are integrated into production planning
SVCM5	Social responsibility standards govern workforce management across the value chain
SVCM6	Sustainability requirements are communicated to suppliers and logistics partners
SVCM7	Environmental performance data is regularly collected and reported
SVCM8	Stakeholders are actively engaged in sustainability planning and reporting
SVCM9	The factory complies with all applicable environmental regulatory requirements
SVCM10	Long-term sustainability planning is integrated into the factory's strategic management

### 3.4 Analytical Procedures

IBM SPSS Statistics Version 26 was used to analyze all data. The analytical sequence was as follows. First, means, standard deviations, and standard errors were calculated for all items and composite dimensions in the study. Second, internal

consistency reliability was assessed using Cronbach's alpha ( $\alpha$ ), with a minimum threshold of  $\alpha \geq 0.70$  and  $\alpha \geq 0.80$  considered indicative of high reliability. Third, corrected item-total correlations were examined, following the recommendations of Anderson and Gerbing (1988), with items showing values below 0.30 flagged for review as potential concerns for convergent validity. Fourth, one-sample t-tests were conducted for each variable using a test value of 3.0 — the midpoint of the Likert scale — to determine whether mean responses significantly deviated from neutrality. Fifth, Pearson product-moment correlation analysis was employed to examine the bivariate relationships among ABC, BSC, and SVCM. Sixth, and most importantly, multiple linear regression analysis was conducted to estimate the individual and combined effects of ABC and BSC on SVCM, using the model:  $SVCM = \beta_0 + \beta_1(ABC) + \beta_2(BSC) + \varepsilon$ . Standardized beta coefficients and  $R^2$  were reported to assess the relative strength of predictors and overall model fit, respectively.

#### 4. Results and Discussion

##### 4.1 Descriptive Statistics

**Table 3: Descriptive Statistics for Study Variables**

Item	Mean	Std. Dev.	Std. Error
ABC1	3.94	0.712	0.085
ABC2	4.03	0.698	0.083
ABC3	3.87	0.741	0.088
ABC4	4.11	0.663	0.079
ABC5	3.76	0.805	0.096
ABC6	4.07	0.677	0.080
ABC7	3.89	0.734	0.087
ABC8	3.72	0.819	0.097
ABC9	4.01	0.688	0.082
ABC10	3.83	0.762	0.090
ABC Total	3.92	0.530	0.063
BSC1	3.85	0.744	0.088
BSC2	3.97	0.701	0.083

Item	Mean	Std. Dev.	Std. Error
BSC3	3.79	0.771	0.092
BSC4	3.68	0.832	0.099
BSC5	3.91	0.722	0.086
BSC6	3.74	0.789	0.094
BSC7	4.02	0.681	0.081
BSC8	3.88	0.733	0.087
BSC9	3.81	0.758	0.090
BSC10	3.95	0.710	0.084
BSC Total	3.86	0.512	0.061
SVCM1	3.99	0.694	0.082
SVCM2	4.08	0.672	0.080
SVCM3	3.93	0.718	0.085
SVCM4	3.86	0.741	0.088
SVCM5	3.77	0.793	0.094
SVCM6	3.71	0.822	0.098
SVCM7	4.05	0.665	0.079
SVCM8	3.82	0.755	0.090
SVCM9	4.12	0.648	0.077
SVCM10	3.89	0.728	0.086
SVCM Total	3.92	0.508	0.060

Perceptions are highly positive across all three constructs among respondents. Item means range from 3.68 (good) to 4.12 (excellent), with all values exceeding the neutral midpoint of 3.0 by a substantial margin (corrected for potential bias). The standard deviations, ranging from 0.648 to 0.832, are relatively moderate, indicating a considerable degree of homogeneity in respondents' views and suggesting that the results are not driven by a small number of extreme outliers. The aggregate mean scores of 3.92 for ABC, 3.86 for BSC, and 3.92 for SVCM indicate a high perceived level of adoption of management accounting tools and a strong level of SVCM effectiveness within the factory.

#### 4.2 Reliability and Validity Analysis

**Table 4: Internal Consistency — ABC Scale**

Item	Scale Deleted	Mean if Deleted	Scale Var. if Deleted	Item-Total r	$\alpha$ if Deleted
ABC1	35.28		21.43	0.612	0.891
ABC2	35.19		21.78	0.638	0.889
ABC3	35.35		21.02	0.594	0.893
ABC4	35.11		22.04	0.659	0.888
ABC5	35.46		20.67	0.573	0.895
ABC6	35.15		21.92	0.643	0.889
ABC7	35.33		21.18	0.606	0.892
ABC8	35.50		20.44	0.561	0.896
ABC9	35.21		21.63	0.627	0.890
ABC10	35.39		20.89	0.584	0.894

**Table 5: Internal Consistency — BSC Scale**

Item	Scale Deleted	Mean if Deleted	Scale Var. if Deleted	Item-Total r	$\alpha$ if Deleted
BSC1	34.76		21.15	0.598	0.889
BSC2	34.64		21.52	0.621	0.887
BSC3	34.82		20.88	0.581	0.891
BSC4	34.93		20.44	0.558	0.893
BSC5	34.70		21.29	0.607	0.888
BSC6	34.87		20.71	0.572	0.892
BSC7	34.59		21.67	0.634	0.886
BSC8	34.73		21.08	0.596	0.889
BSC9	34.80		20.95	0.584	0.891
BSC10	34.66		21.39	0.614	0.887

**Table 6: Cronbach's Alpha Reliability Summary**

Variable	Items	Cronbach's $\alpha$	Reliability Assessment
ABC	10	0.897	Excellent
BSC	10	0.893	Excellent
SVCM	10	0.901	Excellent

All three scales demonstrate high internal consistency, with Cronbach's alpha coefficients exceeding 0.89 — well above both the minimum acceptable threshold of 0.70 and the high-reliability benchmark of 0.80. Individual items also show strong convergence with their respective constructs, as all corrected item-total correlations are greater than 0.55. Furthermore, the overall alpha values could not be substantially improved by deleting any items, indicating strong dimensional integrity and structural stability of each scale.

### 4.3 Hypothesis Testing: One-Sample t-Tests

**Table 6: One-Sample t-Test Results — ABC Dimension (Test Value = 3)**

Item	Mean	t-value	df	p-value	Decision
ABC1	3.94	11.06	70	< 0.001	Accept H1
ABC2	4.03	12.41	70	< 0.001	Accept H1
ABC3	3.87	9.89	70	< 0.001	Accept H1
ABC4	4.11	13.97	70	< 0.001	Accept H1
ABC5	3.76	7.92	70	< 0.001	Accept H1
ABC6	4.07	13.38	70	< 0.001	Accept H1
ABC7	3.89	10.23	70	< 0.001	Accept H1
ABC8	3.72	7.41	70	< 0.001	Accept H1
ABC9	4.01	12.32	70	< 0.001	Accept H1
ABC10	3.83	9.21	70	< 0.001	Accept H1
ABC Overall	3.92	14.60	70	< 0.001	Accept H1

**Table 7: One-Sample t-Test Results — BSC Dimension (Test Value = 3)**

Item	Mean	t-value	df	p-value	Decision
BSC1	3.85	9.66	70	< 0.001	Accept H2
BSC2	3.97	11.69	70	< 0.001	Accept H2
BSC3	3.79	8.59	70	< 0.001	Accept H2
BSC4	3.68	6.87	70	< 0.001	Accept H2
BSC5	3.91	10.58	70	< 0.001	Accept H2
BSC6	3.74	7.87	70	< 0.001	Accept H2
BSC7	4.02	12.59	70	< 0.001	Accept H2
BSC8	3.88	10.11	70	< 0.001	Accept H2

Item	Mean	t-value	df	p-value	Decision
BSC9	3.81	9.01	70	< 0.001	Accept H2
BSC10	3.95	11.31	70	< 0.001	Accept H2
BSC Overall	3.86	14.16	70	< 0.001	Accept H2

Mean scores for both ABC and BSC significantly exceed their neutral midpoints (all  $p < 0.001$  based on one-sample t-tests for each item and aggregate measure). For ABC, the mean value of 3.92 yields  $t(70) = 14.60$ ,  $p < 0.001$ , providing strong support for H1. Similarly, the overall mean of 3.86 for BSC produces  $t(70) = 14.16$ ,  $p < 0.001$ , supporting H2. These results confirm that employees perceive clearly above-neutral levels of both ABC implementation and BSC-based sustainability performance management within the factory, rather than marginal deviations from neutrality.

#### 4.4 Pearson Correlation Analysis

**Table 8: Pearson Correlation Matrix (\*\*  $p < 0.01$ , two-tailed)**

Variable	ABC	BSC	SVCM
ABC	1.000		
BSC	0.714**	1.000	
SVCM	0.783**	0.741**	1.000

Correlation analysis reveals strong, statistically significant, positive relationships among all three constructs. The correlation between ABC and SVCM ( $r = 0.783$ ) is slightly higher than that between BSC and SVCM ( $r = 0.741$ ), offering preliminary support for H4, suggesting that ABC's operational cost transparency may be more directly associated with SVCM outcomes than BSC's strategic alignment function. Additionally, the correlation between ABC and BSC ( $r = 0.714$ ) indicates that the two tools are complementary rather than redundant. Importantly, none of the correlation coefficients exceed 0.85, indicating that multicollinearity is unlikely to bias regression estimates.

## 4.5 Multiple Regression Analysis

**Table 9: Multiple Regression Results — Dependent Variable: SVCM**

Predictor	Unstd. $\beta$	Std. Error	Std. $\beta$	t-value	p-value
Constant	0.487	0.241	—	2.021	0.047
ABC	0.512	0.074	0.504	6.919	< 0.001
BSC	0.389	0.081	0.348	4.802	< 0.001
R <sup>2</sup>	0.681				
Adj. R <sup>2</sup>	0.671				
F-statistic	73.44			p < 0.001	

The regression model is highly statistically significant ( $F(2,68) = 73.44$ ,  $p < 0.001$ ) and explains 68.1% of the variance in SVCM ( $R^2 = 0.681$ , Adjusted  $R^2 = 0.671$ ). Confirming H1 and H4, ABC emerges as the strongest predictor (standardized  $\beta = 0.504$ ,  $t = 6.919$ ,  $p < 0.001$ ). BSC also contributes independently and significantly ( $\beta = 0.348$ ,  $t = 4.802$ ,  $p < 0.001$ ), supporting H2. These findings provide additional support for H3 and H5, as both predictors are simultaneously significant within the model. Variance Inflation Factors for both variables are 2.04 — well below the conventional threshold of 10 — indicating no multicollinearity concerns. The Kolmogorov–Smirnov test ( $D = 0.071$ ,  $p = 0.200$ ) confirms the normality of residuals, while visual inspection of residual-versus-fitted plots shows no evidence of heteroscedasticity.

## 4.6 Discussion in Relation to Previous Research

The finding that ABC exerts a stronger predictive effect on SVCM (H1 supported,  $\beta = 0.504$ ) is both theoretically consistent and practically insightful. ABC's activity-level approach to cost attribution is particularly suited to identifying environmental cost drivers embedded within complex manufacturing overhead structures — including chemical inputs, water consumption, energy use in dyeing processes, and waste disposal — which are often obscured in traditional costing systems. By making these costs visible and linking them to specific processes and

outputs, ABC provides critical information that supports managerial decisions aimed at reducing environmental impact, improving process efficiency, and enhancing resource utilization. This result aligns with contingency theory, which suggests that the effectiveness of management accounting tools depends on their fit with the operational context. In production environments where environmental costs are deeply embedded in activities, ABC offers a more direct pathway to improving SVCM outcomes than tools primarily focused on strategic communication.

The significant positive impact of BSC on SVCM (H2 supported,  $\beta = 0.348$ ) highlights its role in translating sustainability objectives into measurable operational targets. By incorporating sustainability indicators across its financial, customer, internal process, and learning perspectives, the BSC creates an integrated system of performance management that embeds sustainability throughout the organizational structure. The comparatively lower beta coefficient for BSC supports H4, indicating that strategic alignment functions as a more indirect driver of SVCM compared to the immediate operational insights provided by ABC. This does not indicate a limitation of the BSC, but rather reflects its position within the broader causal chain linking strategy to operational outcomes.

The model's explanatory power ( $R^2 = 0.681$ ; H3 supported) is substantial, indicating that the combined implementation of ABC and BSC accounts for a significant proportion of variation in SVCM performance. The remaining unexplained variance (31.9%) suggests the influence of additional factors not included in the model, such as organizational culture, leadership commitment, availability of environmental technologies, and regulatory enforcement. These factors represent important avenues for future research.

#### **4.7 Robustness Diagnostics**

Variance Inflation Factors indicate no multicollinearity between ABC (VIF = 2.04) and BSC (VIF = 2.04), as both values are well below the critical threshold of

10, confirming that coefficient estimates are not biased. The Kolmogorov–Smirnov test ( $D = 0.071$ ,  $p = 0.200$ ) supports the assumption of residual normality. Furthermore, visual inspection of residual-versus-fitted-value plots reveals no systematic patterns, indicating the absence of heteroscedasticity. Collectively, these diagnostics provide strong support for the validity of the regression model and the reliability of the substantive conclusions drawn from it.

## **5. Conclusions, Recommendations, and Future Directions**

### **5.1 Summary of Principal Findings**

This study examined the role of Activity-Based Costing and the Balanced Scorecard in enhancing Sustainable Value Chain Management at the Wasit Textile and Sewing Factory, a private-sector manufacturing enterprise in Iraq. All five hypotheses received strong empirical support. Both tools positively and significantly influence SVCM and together explain 68.1% of its variance. ABC emerges as the stronger predictor ( $\beta = 0.504$ ), reflecting its effectiveness in improving operational efficiency through cost traceability and in identifying and mitigating environmental costs embedded in complex production processes. The BSC also contributes significantly ( $\beta = 0.348$ ) through its role in aligning sustainability strategy and enhancing performance measurement. Collectively, these findings provide novel quantitative evidence from an underrepresented developing economy context on the effectiveness of integrated sustainability-oriented management accounting systems.

### **5.2 Practical Recommendations**

Factory managers should prioritize expanding ABC systems to incorporate environmental cost drivers such as chemical usage, water consumption, and energy utilization, supported by targeted staff training in sustainability-oriented cost accounting. Additionally, the factory should implement a Sustainability Balanced Scorecard framework, integrating environmental and social key performance indicators across all perspectives. At the policy level, Iraqi industrial authorities

should develop accounting modernization programs targeting manufacturing firms, particularly state-owned enterprises, providing technical support and capacity-building initiatives to facilitate the adoption of sustainability-oriented accounting systems. Given the institutional barriers identified in prior research [13], such programs should address both technical and organizational challenges.

### **5.3 Limitations**

This study has four primary limitations. First, the single-case design limits the generalizability of the findings. Second, the use of self-reported questionnaire data introduces the potential for social desirability bias. Third, the cross-sectional nature of the study restricts causal inference, allowing only for correlational interpretation. Fourth, the focus on ABC and BSC excludes other relevant accounting tools, such as Life Cycle Costing and Material Flow Cost Accounting, potentially limiting the comprehensiveness of the accounting–SVCM relationship examined.

### **5.4 Directions for Future Research**

Future research should extend this framework to multi-firm and cross-sector studies to assess the generalizability of the ABC–BSC–SVCM relationship across different industrial and institutional contexts. Longitudinal designs would be particularly valuable in establishing causal relationships and tracking changes in sustainability performance over time. Additionally, integrating objective sustainability performance data — such as energy consumption, waste generation, and emissions — with perceptual survey data would strengthen empirical validity. Qualitative and mixed-method approaches could further explore the organizational processes through which ABC and BSC implementation translates into sustainability outcomes. Finally, replication studies in other Iraqi regions and developing economy contexts would help address the limitations inherent in single-case research designs.

## References

- [1] Y. Agyabeng-Mensah, R. Oloruntoba, J. Earnest, and H. Mohammadi, "Sustainable supply chain management and performance outcomes: Supply chain practice view and mediated moderation perspectives," *Bus. Strategy Environ.*, vol. 34, no. 7, pp. 8237–8258, 2025. <https://doi.org/10.1002/bse.70023>
- [2] P. Budsaratragoon and B. Jitmaneeroj, "Corporate sustainability and stock value in Asian-Pacific emerging markets: Synergies or tradeoffs among ESG factors?" *Sustainability*, vol. 13, no. 11, Art. no. 6458, 2021. <https://doi.org/10.3390/su13116458>
- [3] R. Chourasiya, S. Pandey, and R. K. Malviya, "Sustainable manufacturing adoption in textile industries: A systematic state-of-art literature review and future research outline," *Sustain. Dev.*, vol. 31, no. 2, pp. 612–638, 2023. <https://doi.org/10.1002/sd.2434>
- [4] B. D. Dagidir and B. Ozkan, "A comprehensive evaluation of a company performance using sustainability balanced scorecard based on picture fuzzy AHP," *J. Clean. Prod.*, vol. 435, Art. no. 140519, 2024. <https://doi.org/10.1016/j.jclepro.2023.140519>
- [5] A. Eifert and C. Julmi, "Challenges and how to overcome them in the formulation and implementation process of a sustainability balanced scorecard (SBSC)," *Sustainability*, vol. 14, no. 22, Art. no. 14816, 2022. <https://doi.org/10.3390/su142214816>
- [6] A. Farrukh and A. Sajjad, "Drivers for and barriers to circular economy transition in the textile industry: A developing economy perspective," *Sustain. Dev.*, vol. 32, no. 6, pp. 7309–7329, 2024. <https://doi.org/10.1002/sd.3088>
- [7] F. Figge, T. Hahn, S. Schaltegger, and M. Wagner, "The sustainability balanced scorecard — Linking sustainability management to business strategy," *Bus.*

- Strategy Environ., vol. 11, no. 5, pp. 269–284, 2002.  
<https://doi.org/10.1002/bse.339>
- [8] N. M. Fuzi et al., "Sustainability management accounting and organizational performance: The mediating role of environmental management system," Sustainability, vol. 14, no. 21, Art. no. 14290, 2022.  
<https://doi.org/10.3390/su142114290>
- [9] M. Hamdoun, M. A. Achabou, and S. Dekhili, "Could CSR improve the financial performance of developing countries' firms? Analyses of mediating effect of intangible resources," Eur. Bus. Rev., vol. 34, no. 1, pp. 41–61, 2022.  
<https://doi.org/10.1108/EBR-09-2019-0236>
- [10] B. Harsanto, I. Primiana, V. Sarasi, and Y. Satyakti, "Sustainability innovation in the textile industry: A systematic review," Sustainability, vol. 15, no. 2, p. 1549, 2023. <https://doi.org/10.3390/su15021549>
- [11] M. M. Islam, P. Perry, and S. Gill, "Mapping environmentally sustainable practices in textiles, apparel and fashion industries: A systematic literature review," J. Fashion Mark. Manag., vol. 25, no. 2, pp. 331–353, 2021.  
<https://doi.org/10.1108/JFMM-07-2020-0130>
- [12] R. S. Kaplan and D. P. Norton, "The balanced scorecard: Measures that drive performance," Harvard Bus. Rev., vol. 70, no. 1, pp. 71–79, 1992.
- [13] H. M. Kareem et al., "The role of accounting information system and knowledge management to enhancing organizational performance in Iraqi SMEs," Sustainability, vol. 13, no. 22, Art. no. 12706, 2021.  
<https://doi.org/10.3390/su132212706>
- [14] J. Kumar, N. Prince, and H. K. Baker, "Balanced scorecard: A systematic literature review and future research issues," FIIB Bus. Rev., vol. 11, no. 2, pp. 147–161, 2022. <https://doi.org/10.1177/231971452111049625>

- [15] S. Kumar et al., "Balanced scorecard: Trends, developments, and future directions," *Rev. Manag. Sci.*, vol. 18, no. 8, pp. 2397–2439, 2024. <https://doi.org/10.1007/s11846-023-00700-6>
- [16] C. Mio, A. Costantini, and S. Panfilo, "Performance measurement tools for sustainable business: A systematic literature review on the sustainability balanced scorecard use," *Corp. Soc. Responsib. Environ. Manag.*, vol. 29, no. 2, pp. 367–384, 2022. <https://doi.org/10.1002/csr.2206>
- [17] S. Mukwarami, C. Nkwaira, and H. M. van der Poll, "Environmental management accounting implementation challenges and supply chain management in emerging economies' manufacturing sector," *Sustainability*, vol. 15, no. 2, Art. no. 1061, 2023. <https://doi.org/10.3390/su15021061>
- [18] T. H. Nguyen et al., "The impact of contingency factors on the application of strategic management accounting in Vietnamese manufacturing enterprises," *Cogent Bus. Manag.*, vol. 10, no. 2, Art. no. 2218173, 2023. <https://doi.org/10.1080/23311975.2023.2218173>
- [19] V. Ortiz-Cea et al., "The role of activity-based costing in reducing environmental impact: A systematic literature review," *Sustainability*, vol. 17, no. 3, Art. no. 1275, 2025. <https://doi.org/10.3390/su17031275>
- [20] P. Quesado and R. Silva, "Activity-based costing (ABC) and its implication for open innovation," *J. Open Innov. Technol. Mark. Complex.*, vol. 7, no. 1, Art. no. 41, 2021. <https://doi.org/10.3390/joitmc7010041>
- [21] P. Quesado, H. Costa Oliveira, and R. Silva, "Integrating sustainability goals into the balanced scorecard: A bibliometric analysis of the sustainability balanced scorecard," *Meas. Bus. Excell.*, vol. 29, no. 2, pp. 352–367, 2025. <https://doi.org/10.1108/MBE-09-2024-0139>

- [22] M.-V. Sanchez-Rebull, A. Ninerola, and A.-B. Hernandez-Lara, "After 30 years, what has happened to activity-based costing? A systematic literature review," *SAGE Open*, vol. 13, no. 2, 2023. <https://doi.org/10.1177/21582440231178785>
- [23] S. Seuring and M. Muller, "From a literature review to a conceptual framework for sustainable supply chain management," *J. Clean. Prod.*, vol. 16, no. 15, pp. 1699–1710, 2008. <https://doi.org/10.1016/j.jclepro.2008.04.020>
- [24] F. F. Y. Siagian et al., "The application of contingency theory in accounting and management practice: A systematic literature review from 2013 to 2023," *ShodhPrabandhan J. Manag. Stud.*, vol. 2, no. 1, pp. 1–20, 2025. <https://doi.org/10.29121/ShodhPrabandhan.v2.i1.2025.10>
- [25] M. M. Swalih, R. Ram, and E. Tew, "Environmental management accounting for strategic decision-making: A systematic literature review," *Bus. Strategy Environ.*, vol. 33, no. 7, pp. 6335–6367, 2024. <https://doi.org/10.1002/bse.3828>
- [26] Z. Yu et al., "Sustainable supply chain management and green technologies: A bibliometric review of literature," *Environ. Sci. Pollut. Res.*, vol. 29, pp. 58454–58470, 2022. <https://doi.org/10.1007/s11356-022-21544-9>