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Analysis Of Supply Chain Management Effectiveness in Improving Project Time and Cost Performance Through Digitalism Supply Chain Management

(A Case Study of the Demineralized Facility Construction Project at Company ABC)

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ABSTRACT

The increasing complexity of oil and gas construction projects requires effective Supply Chain Management (SCM) supported by digital integration to achieve efficient schedule and cost performance. This study aims to analyze the effectiveness of SCM and Digital Supply Chain Management (DSCM) in the Demineralized Facility Construction Project at Company ABC. A quantitative approach was employed using purposive sampling involving 58 respondents engaged in supply chain, procurement, engineering, logistics, project management, and contractor activities. Primary data were collected through a structured five-point Likert-scale questionnaire and analyzed using IBM SPSS Statistics 31 through validity, reliability, multicollinearity, descriptive, and multiple linear regression analyses. The independent variables comprised SCM practices and DSCM implementation through Smart-GEP, Enterprise Resource Planning (ERP), and IOG E-Commerce, while the dependent variable was project performance, measured through schedule and cost performance. The regression model was statistically significant ($F = 107.953$, $p < 0.001$) and explained 79.7% of the variation in project performance ($R^2 = 0.797$). DSCM showed a significant positive effect on project performance, demonstrating that integrated digital platforms strengthen procurement transparency, information integration, real-time monitoring, and project coordination. These findings emphasize the strategic contribution of DSCM to schedule and cost performance in oil and gas construction projects.

1. Introduction

The oil and gas construction industry plays a strategic role in supporting Indonesia's national economic development. Construction projects in this sector are generally characterized by high complexity, involving multidisciplinary stakeholders, extensive supply chains, strict regulatory compliance, and substantial financial investments. Consequently, project success is highly dependent on effective management of project schedules, costs, procurement, logistics, and information flows



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throughout the project lifecycle [1], [2], [3]. Delays in material delivery, inefficient procurement processes, inaccurate inventory management, and poor coordination among project stakeholders frequently contribute to cost overruns and schedule deviations, ultimately reducing overall project performance and organizational competitiveness [4], [5], [6]. These vulnerabilities have increased the need for digitally enabled supply chain systems capable of providing greater visibility, integration, and responsiveness across project activities. In response, engineering and construction companies have increasingly adopted digital technologies to strengthen collaboration, improve information accuracy, accelerate decision-making, and integrate supply chain processes. Thus, digital transformation has emerged as a strategic mechanism for addressing supply chain inefficiencies and improving the time and cost performance of complex oil and gas construction projects [7].

Company ABC, as an upstream oil and gas company in Indonesia, continues to improve operational efficiency through digital transformation initiatives across its business processes. One strategic initiative involves integrating digital technologies into Supply Chain Management (SCM) activities to improve procurement performance, logistics coordination, inventory control, information exchange, and project execution. The Demineralized Facility Construction Project at Company ABC represents a relevant case because its execution involves interdependent procurement, material supply, logistics, engineering, contractor, and project management activities, which reflect many of the supply chain complexities commonly encountered in oil and gas construction projects. Delays or inaccuracies within one supply chain function may consequently affect material availability, construction progress, project schedules, and costs. Operational challenges related to procurement delays, fragmented communication, inventory accuracy, and coordination among project participants further demonstrate the importance of an integrated supply chain approach. Accordingly, integrated digital platforms are expected to strengthen supply chain transparency, interdepartmental coordination, and the timeliness and accuracy of managerial decision-making [8], [9].

To address these challenges, Company ABC has implemented several digital platforms as part of Digital Supply Chain Management (DSCM), including Smart-GEP (Integrated Supply Chain Management and Government Electronic Procurement), Enterprise Resource Planning (ERP), and IOG E-Commerce. These platforms perform interconnected functions across the supply chain. Smart-GEP supports procurement administration and monitoring, ERP facilitates the integration of operational, financial, and inventory information, while IOG E-Commerce supports electronic transactions and interactions with suppliers. Their integration is intended to create a connected digital ecosystem encompassing procurement planning, vendor management, financial administration, inventory monitoring, logistics coordination, and project execution. Through this integration, real-time information can be exchanged across organizational functions, potentially improving decision-making, procurement transparency, administrative efficiency, and timely project delivery. Previous studies have similarly demonstrated that digital procurement and ERP integration can reduce procurement lead times, improve information accuracy, strengthen supplier collaboration, and enhance organizational performance [10], [11]. In this study, conventional SCM practices (X_1) and the integrated implementation of DSCM through Smart-GEP, ERP, and IOG E-Commerce (X_2) are examined as independent variables in relation to project time and cost performance (Y).

Previous studies have demonstrated that digital transformation contributes to supply chain visibility, procurement efficiency, inventory management, and project coordination in the construction industry [12]. ERP implementation has been associated with improvements in operational performance, while electronic procurement systems can shorten procurement cycles and increase process transparency [13]. Similarly, digital marketplaces can facilitate supplier collaboration and procurement flexibility, whereas technologies such as the Internet of Things (IoT), Building Information Modeling (BIM), blockchain, and digital twins offer opportunities for greater supply chain integration and real-time project monitoring [14]. However, much of the existing literature examines individual technologies or digital applications separately, such as ERP, e-procurement, BIM, blockchain, or other digital supply chain technologies [15]. Consequently, empirical understanding of how multiple interconnected digital platforms jointly support supply chain processes remains limited, particularly for the simultaneous integration of Smart-GEP, ERP, and IOG E-Commerce within oil and gas construction projects. Examining these three platforms as an integrated DSCM system therefore provides an opportunity to address the multi-platform integration gap in the existing literature.

Furthermore, many existing studies primarily evaluate organizational or manufacturing performance rather than project-based time and cost performance. Construction projects have distinctive characteristics, including temporary organizational structures, complex stakeholder relationships, strict procurement requirements, and dynamic material and logistics demands, which can make digital supply chain integration more challenging [16]. Within Indonesia's upstream oil and gas sector, empirical evidence concerning the effectiveness of Digital Supply Chain Management (DSCM) in improving construction project performance remains limited. Existing studies frequently focus on manufacturing environments, general organizational performance, or individual digital systems without simultaneously considering the interaction of procurement, ERP, and digital marketplace platforms [17]. This limitation provides a direct rationale for examining whether conventional SCM practices and integrated DSCM contribute to project schedule and cost performance within an Indonesian upstream oil and gas construction environment.

Although previous studies have shown that ERP, electronic procurement, digital marketplace platforms, IoT, and other digital technologies can individually enhance procurement and supply chain performance, limited empirical research has examined the integrated implementation of Smart-GEP, ERP, and IOG E-Commerce within a single oil and gas construction project. Moreover, empirical evidence remains insufficient regarding how conventional SCM practices and an integrated multi-platform DSCM system jointly relate to project-based outcomes, particularly schedule and cost performance in Indonesia's upstream oil and gas sector [18]. This study addresses this gap by statistically examining the simultaneous effects of SCM practices and integrated DSCM, represented by Smart-GEP, ERP, and IOG E-Commerce, on project time and cost performance within the Indonesian oil and gas construction context.

The novelty of this study lies in its empirical evaluation of an integrated Digital Supply Chain Management framework combining Smart-GEP, ERP, and IOG E-Commerce within the Demineralized Facility Construction Project at Company ABC. Unlike previous studies that predominantly investigate individual digital technologies, this research evaluates these platforms as interconnected components of DSCM and examines their contribution alongside conventional SCM practices to project performance [19], [20]. The study specifically integrates the dimensions of material planning, supplier coordination, logistics management, information integration, and risk management with digital procurement, enterprise information integration, and electronic supplier transactions. The novelty therefore lies not merely in the use of digital technologies, but in quantitatively evaluating a multi-platform DSCM configuration and its relationship with project schedule and cost performance in an Indonesian upstream oil and gas construction project.

Therefore, this study aims to analyze the effects of Supply Chain Management practices and Digital Supply Chain Management on project performance in the Demineralized Facility Construction Project at Company ABC. Specifically, the study examines SCM practices through material planning, supplier coordination, logistics management, information integration, and risk management, while DSCM is represented by the integrated implementation of Smart-GEP, ERP, and IOG E-Commerce. Project performance is evaluated in terms of schedule performance and cost performance. The study further examines the partial and simultaneous relationships between these independent variables and project performance through quantitative statistical analysis.

The findings of this study are expected to provide both theoretical and practical contributions. From an academic perspective, the study extends the understanding of digital supply chain integration in construction project management by providing empirical evidence from the upstream oil and gas sector. It also contributes to the literature by positioning multiple digital platforms within an integrated DSCM framework rather than evaluating them independently. From a practical perspective, the findings can support project managers and supply chain practitioners in evaluating the role of integrated digital procurement, enterprise information systems, and electronic supplier platforms in project execution. Ultimately, the study provides an empirical basis for strengthening digital supply chain strategies aimed at achieving more effective schedule and cost performance in complex oil and gas construction projects.

2. Research Method

This study employed a quantitative research approach to examine the effects of Supply Chain Management (SCM) practices and Digital Supply Chain Management (DSCM) on project performance in terms of schedule and cost performance. The quantitative approach was selected because it enables

objective measurement of research variables and statistical examination of relationships among variables. The study was conducted as a case study of the Demineralized Facility Construction Project at Company ABC Field, Banggai Regency, Central Sulawesi, Indonesia. The project was selected because it has implemented integrated digital supply chain platforms, including Smart-GEP, Enterprise Resource Planning (ERP), and IOG E-Commerce, making it an appropriate case for evaluating DSCM implementation in construction project management.

The research was conducted between October and December 2025, covering research preparation, questionnaire development, data collection, statistical analysis, and interpretation of the results. The research procedure consisted of five sequential stages: (1) identification of research problems and literature review, (2) questionnaire development and expert validation, (3) field data collection, (4) statistical data analysis, and (5) interpretation of findings and formulation of recommendations.

The target population comprised personnel directly involved in supply chain and project execution activities within the Demineralized Facility Construction Project. Respondents included personnel from the Supply Chain Management Division, Production and Project Division, field management, and contractor/vendor organizations. A total sampling (census) technique with purposive inclusion criteria was employed. The purposive criteria were used to identify personnel with relevant involvement and experience in SCM and DSCM activities, after which all 58 eligible members of the target population were included as respondents. A total of 58 respondents participated in the survey, including procurement officers, supply chain personnel, project engineers, warehouse personnel, managers, and contractors involved in project execution.

Primary data were collected using a structured questionnaire based on a five-point Likert scale, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The questionnaire consisted of four sections: respondent characteristics, SCM practices, DSCM implementation, and project performance. Secondary data were obtained from available project documentation, including procurement records, logistics reports, project progress reports, and project financial data. Limited unstructured interviews were also conducted with key personnel, including the Head of Supply Chain Management, Field Manager, and Project Engineer. These interviews were not treated as a separate qualitative research component or analyzed as independent variables. Instead, they were used strictly for qualitative triangulation to support the interpretation and contextual validation of the quantitative questionnaire findings. Therefore, the overall research design remained quantitative.

Three research variables were investigated. The first independent variable, Supply Chain Management Practices (X_1), consisted of five dimensions: material planning, supplier coordination, logistics management, information integration, and risk management. The second independent variable, Digital Supply Chain Management (X_2), was represented by the integrated implementation of Smart-GEP, ERP, and IOG E-Commerce. The dependent variable, Project Performance (Y), was operationalized as a composite construct comprising schedule performance and cost performance. Thus, schedule and cost performance were treated as dimensions of the overall project performance construct rather than as separate dependent variables in two independent regression models. Altogether, the questionnaire contained 46 measurement items distributed across the three research variables.

Prior to hypothesis testing, the questionnaire instrument was evaluated through validity and reliability tests. Item validity was assessed using the Pearson Product-Moment correlation, while internal consistency reliability was evaluated using Cronbach's Alpha. Multicollinearity testing was subsequently conducted using Tolerance and Variance Inflation Factor (VIF) values to determine whether problematic correlations existed between the independent variables. All statistical analyses were performed using IBM SPSS Statistics Version 31.

Descriptive statistical analysis was initially performed to summarize respondents' assessments of SCM practices, DSCM implementation, and project performance. Subsequently, a single multiple linear regression model was estimated using SCM Practices (X_1) and DSCM (X_2) as independent variables and the composite Project Performance (Y) construct as the dependent variable. The regression model was formulated as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

Where Y represents Project Performance, X_1 represents SCM Practices, X_2 represents DSCM implementation, β_0 is the constant, β_1 and β_2 are regression coefficients, and ε represents the error term. The t-test was used to evaluate the partial effect of each independent variable on the composite project performance construct, whereas the F-test was used to evaluate the simultaneous effect of SCM Practices

and DSCM on Project Performance. The coefficient of determination (R^2 and Adjusted R^2) was used to assess the explanatory capability of the regression model. Statistical significance was determined at a 95% confidence level ($\alpha = 0.05$).

3. Description and Technical

3.1 Population and Samples

The population of this study comprised personnel directly involved in the Supply Chain Management (SCM) activities of the Demineralized Facility Construction Project at ABC Field, Banggai Regency, Central Sulawesi. The respondents represented both internal and external stakeholders participating in procurement, engineering, logistics, warehouse operations, construction management, and contractor organizations. The population consisted of personnel from the Supply Chain Management Division (21 respondents), Production and Project Division (17 respondents), Donggi Matindok Field Management (12 respondents), and contractor/vendor organizations (8 respondents), resulting in a total of 58 respondents. Because the population size was relatively small and all respondents met the research criteria, the entire population was used as the research sample.

3.2 Sampling Techniques

The study employed a total sampling (census) technique with purposive inclusion criteria, whereby all 58 eligible members of the target population who met the predefined criteria were included as respondents. The inclusion criteria required respondents to: (1) be directly involved in supply chain, procurement, logistics, engineering, construction, or project management activities within the Demineralized Facility Construction Project; (2) have direct knowledge of or experience using at least one Digital Supply Chain Management (DSCM) platform, namely Smart-GEP, Enterprise Resource Planning (ERP), or IOG E-Commerce; and (3) participate in operational or decision-making activities related to project execution. The purposive criteria were applied to define the eligible population, while total sampling was subsequently used to include all qualified members. This approach resulted in 58 respondents and ensured that the collected data represented personnel with relevant knowledge and practical experience regarding SCM practices and DSCM implementation within the project environment.

3.3 Definition of Variable Operations

The research investigated two independent variables and one dependent variable. The first independent variable, Supply Chain Management (SCM) (X_1), represents the effectiveness of material planning, supplier coordination, logistics management, information integration, and supply chain risk management. This variable was measured using 18 questionnaire items grouped into five dimensions.

The second independent variable, Digitalism Supply Chain Management (X_2), represents the implementation level of digital technologies supporting supply chain activities, including Smart-GEP, Enterprise Resource Planning (ERP), and IOG E-Commerce. This variable consisted of 18 measurement items distributed across three dimensions.

The dependent variable, Project Performance (Y), represents the effectiveness of project implementation based on schedule performance and cost performance. The variable was measured using 10 questionnaire items covering two dimensions: time performance and cost performance. All questionnaire items employed a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Table 1. Operational Definition of Variables

Variable	Operational Definition	Dimensions	Number of Items
SCM (X_1)	Effectiveness of supply chain management practices in construction projects	Material Planning, Supplier Coordination, Logistics Management, Information Integration, Risk Management	18
Digitalism SCM (X_2)	Degree of implementation of digital technologies supporting supply chain management	Smart-GEP, ERP, IOG E-Commerce	18

Variable	Operational Definition	Dimensions	Number of Items
Project Performance (Y)	Achievement of project objectives in terms of schedule and cost performance	Time Performance, Cost Performance	10

Source: Processed Data, 2026

3.4 Instrument Analysis Tool

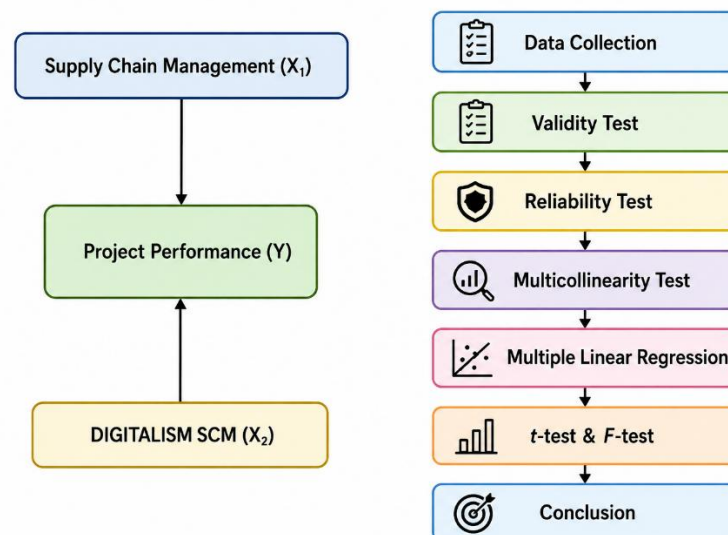
The research instrument consisted of a structured questionnaire developed from previous studies on Supply Chain Management, Enterprise Resource Planning, electronic procurement systems, and project performance measurement. Before hypothesis testing, the instrument was evaluated through validity and reliability testing. Construct validity was assessed using the Pearson Product-Moment correlation, where questionnaire items with correlation coefficients greater than the critical R-value were considered valid. Instrument reliability was evaluated using Cronbach's Alpha, with values of 0.70 or higher indicating acceptable internal consistency.

To satisfy the assumptions of multiple regression analysis, multicollinearity testing was also performed using Variance Inflation Factor (VIF) and Tolerance values. Statistical analysis was conducted using IBM SPSS Statistics Version 31.

3.5 Data Analysis Techniques

The collected data were analyzed using IBM SPSS Statistics Version 31. The analysis consisted of descriptive statistics, instrument testing, assumption testing, and hypothesis testing. Descriptive statistics were used to summarize respondent characteristics and variable distributions. Instrument quality was evaluated using validity and reliability tests, while multicollinearity testing ensured that the independent variables did not exhibit strong correlations.

The relationships among variables were examined using multiple linear regression analysis. Three research hypotheses were tested. The t-test was employed to determine the partial effect of each independent variable on project performance, whereas the F-test was used to evaluate the simultaneous influence of Supply Chain Management practices and Digitalism SCM implementation on project schedule and cost performance. Statistical significance was determined at a 95% confidence level ($\alpha = 0.05$).



Source: Processed Data, 2026.

Figure 1. Research Framework

4. Results and Discussions

4.1 Respondent Characteristics

The study involved 58 respondents representing internal and external stakeholders directly engaged in supply chain management activities in the Demineralized Facility Construction Project at

Company ABC Field. The respondents consisted of Supply Chain Management personnel (36.2%), Production and Project personnel (29.3%), Field Management (20.7%), and contractors/vendors (13.8%). Most respondents were internal staff (60.3%), aged between 30 and 40 years (56.9%), male (94.8%), had more than ten years of professional experience (84.5%), and used Digital Supply Chain Management (DSCM) applications for approximately one to three hours per day (56.9%). These characteristics indicate that the respondents possessed sufficient professional experience and practical exposure to SCM and DSCM activities to provide informed assessments of their implementation within the project environment.

4.2 Hypothesis Testing

Hypothesis testing was performed using the t-test and F-test to determine the partial and simultaneous effects of Supply Chain Management (SCM) practices and DIGITALISM Supply Chain Management on project performance. At a significance level of 5%, the critical values used in this study were a t-table value of 2.004 and an F-table value of 4.016.

The partial hypothesis testing results indicate that SCM Practices (X_1) have a significant effect on Project Performance (Y), with a t-value of 8.151, which is higher than the t-table value of 2.004, and a significance value of < 0.001 . Therefore, H1 is accepted. This finding indicates that improvements in material planning, supplier coordination, logistics management, information integration, and supply chain risk management contribute significantly to improving project schedule and cost performance.

Table 2. Summary of Hypothesis Testing Results

Hypothesis	Relationship	B	t-value	F-value	Sig.	Decision
H1	SCM Practices (X_1) → Project Performance (Y)	0.049	8.151	–	< 0.001	Accepted
H2	Digitalism SCM (X_2) → Project Performance (Y)	0.475	7.326	–	< 0.001	Accepted
H3	SCM Practices (X_1) and Digitalism SCM (X_2) → Project Performance (Y)	–	–	107.953	< 0.001	Accepted

Similarly, DIGITALISM SCM (X_2) has a statistically significant effect on Project Performance (Y), with a t-value of 7.326, exceeding the t-table value of 2.004, and a significance value of < 0.001 . Therefore, H2 is accepted. This result demonstrates that the implementation of SMART-GEP, ERP, and IOG E-Commerce contributes significantly to project performance by supporting digital procurement, information integration, real-time monitoring, administrative accuracy, and decision-making processes.

The simultaneous F-test further demonstrates that SCM Practices (X_1) and DIGITALISM SCM (X_2) jointly have a significant effect on Project Performance (Y). The analysis yielded an F-value of 107.953, substantially higher than the F-table value of 4.016, with a significance value of < 0.001 . Consequently, H3 is accepted. These findings confirm that the integration of conventional SCM practices with digital supply chain technologies provides a significant contribution to improving overall project performance, particularly in terms of schedule and cost efficiency.

Table 3. ANOVA Results for Simultaneous Effect

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	551.784	2	275.892	107.953	< 0.001
Residual	140.561	55	2.556	–	–
Total	692.345	57	–	–	–

4.3 Descriptive Analysis

The descriptive analysis demonstrates that all dimensions of Supply Chain Management (SCM) and Digitalism SCM received positive evaluations from respondents, with average scores ranging from 3.84 to 4.21, corresponding to the categories of Agree and Strongly Agree. This finding suggests that the implementation of supply chain management practices and digital technologies has been well established throughout the project.

Within the SCM variable, material planning, supplier coordination, logistics management, information integration, and risk management all obtained consistently high mean scores (3.84–4.14),

indicating that procurement planning, inventory control, logistics coordination, communication, and risk mitigation effectively supported project execution.

Similarly, all Digitalism SCM dimensions demonstrated favorable performance. The implementation of Smart-GEP, ERP, and IOG E-Commerce received average scores between 3.93 and 4.21, with several indicators classified as Strongly Agree, particularly those related to administrative accuracy, reporting reliability, and system integration. These results indicate that digital platforms substantially improved procurement transparency, operational efficiency, real-time information sharing, and coordination among project stakeholders.

Table 4. Summary of Descriptive Results

Variable	Dimension	Number of Items	Mean Score	Category	Interpretation
Supply Chain Management (X ₁)	Material Planning	4	3.89	Agree	Material planning has been systematically implemented and effectively supports project execution.
	Supplier Coordination	4	3.99	Agree	Coordination with suppliers is effective, improving procurement responsiveness and material availability.
	Logistics Management	3	4.06	Agree	Logistics activities support efficient material distribution and inventory control.
	Information Integration	3	4.00	Agree	Information sharing among stakeholders facilitates coordination and decision-making.
	Risk Management	4	4.07	Agree	Supply chain risks are identified and mitigated effectively during project execution.
Average SCM (X ₁)	—	18	4.00	Agree	Overall SCM practices have been effectively implemented in the project.
Digitalism SCM (X ₂)	Smart-GEP	6	4.01	Agree	Smart-GEP enhances procurement transparency, monitoring, and administrative efficiency.
	Enterprise Resource Planning (ERP)	6	4.01	Agree	ERP improves data integration, operational control, and managerial decision-making.
	IOG E-Commerce	6	4.09	Agree	IOG E-Commerce strengthens vendor management and accelerates procurement transactions.
Average Digitalism SCM (X ₂)	—	18	4.04	Agree	Integrated digital platforms effectively support supply chain management processes.
Project Performance (Y)	Schedule Performance	5	4.08	Agree	Digital supply chain implementation contributes to improved project schedule performance.
	Cost Performance	5	4.12	Agree	Digital integration supports cost control and improves project cost efficiency.
Average Project Performance (Y)	—	10	4.10	Agree	Overall project performance is perceived to have improved through Digitalism SCM implementation.

Source: Processed Data, 2026

4.3 Instrument Testing

Instrument evaluation confirmed that all questionnaire items satisfied the required validity and reliability criteria. Pearson correlation analysis showed that the 18 items of SCM Practices (X1) had item-total correlation coefficients ranging from 0.614 to 0.741, while the 18 items of DIGITALISM SCM (X2) ranged from 0.378 to 0.633, and the 10 items of Project Performance (Y1) ranged from 0.436 to 0.850. All correlation coefficients exceeded the critical value of 0.2586 ($n = 58$, $\alpha = 0.05$), indicating that all questionnaire items were valid. Reliability analysis further demonstrated satisfactory internal consistency, with Cronbach's Alpha values of approximately 0.930 for SCM Practices (X1), 0.822 for DIGITALISM SCM (X2), and 0.850 for Project Performance (Y1), all exceeding the minimum criterion of 0.70. Therefore, all items were retained and the research instrument was considered valid and reliable for subsequent statistical analyses.

4.4 Discussion

The findings indicate that effective Supply Chain Management contributes positively to project performance through systematic material planning, supplier collaboration, logistics coordination, information integration, and proactive risk management. These practices enable timely material availability, minimize procurement delays, reduce operational uncertainty, and improve project cost efficiency. This finding supports the Supply Chain Management theory proposed by Christopher (2016), which emphasizes that integrated supply chain processes create competitive advantages through enhanced coordination and responsiveness.

Furthermore, the implementation of Digitalism SCM, represented by Smart-GEP, ERP, and IOG E-Commerce, significantly strengthens supply chain integration by digitalizing procurement activities, improving information transparency, and enabling real-time monitoring of project resources. The high evaluation of ERP reporting accuracy and Smart-GEP administrative functions suggests that digital technologies improve organizational decision-making while reducing administrative errors. These findings are consistent with previous studies indicating that digital transformation enhances supply chain visibility, operational efficiency, and project performance in construction industries.

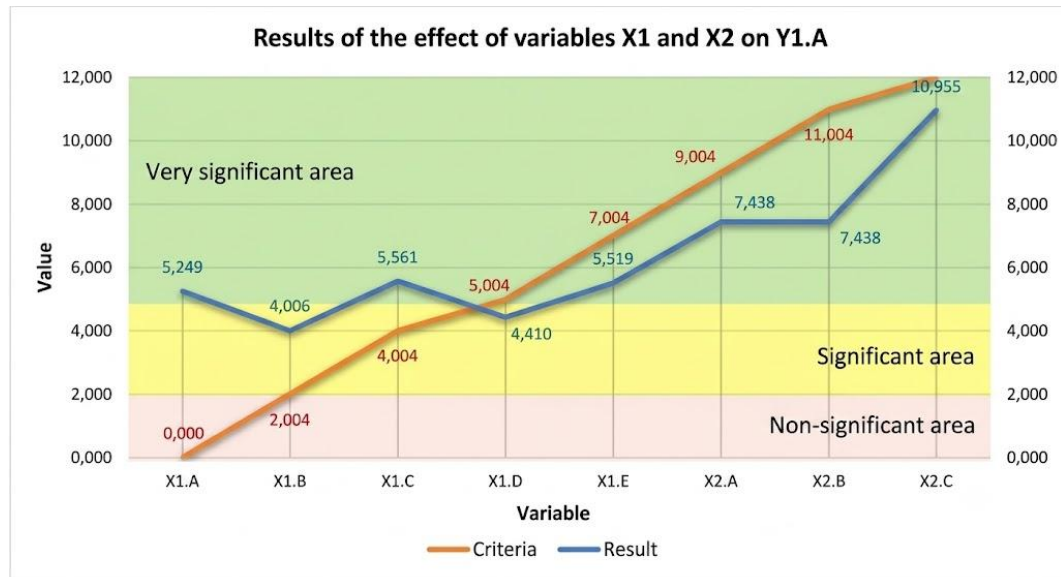
Table 5. Multiple Linear Regression Results for Project Performance

Predictor	B	β	t-value	p-value	Tolerance	VIF
Constant	5.325	–	1.772	0.082	–	–
Supply Chain Management (X ₁)	–0.371	–0.786	–9.129	<0.001	0.498	2.007
Digitalism SCM (X ₂)	0.852	1.256	14.594	<0.001	0.498	2.007

Table 6. Model Statistic Results

Model Statistics	Value
R ²	0.797
Adjusted R ²	0.790
F-statistic	107.953
F-test p-value	<0.001
N	58

The multiple linear regression results indicate that the overall model is statistically significant ($F = 107.953$, $p < 0.001$), demonstrating that Supply Chain Management (X₁) and Digitalism SCM (X₂) simultaneously explain a significant proportion of the variation in Project Performance (Y). The model produces an R² value of 0.797 and an adjusted R² of 0.790, indicating that approximately 79.7% of the variation in project performance can be explained by the two independent variables, while the remaining 20.3% is attributable to other factors outside the model. Digitalism SCM shows a significant positive effect on project performance ($\beta = 1.256$, $t = 14.594$, $p < 0.001$), whereas Supply Chain Management shows a significant negative partial coefficient in the simultaneous model ($\beta = -0.786$, $t = -9.129$, $p < 0.001$). The Tolerance value of 0.498 and VIF of 2.007 for both predictors indicate that the regression model does not exhibit problematic multicollinearity.

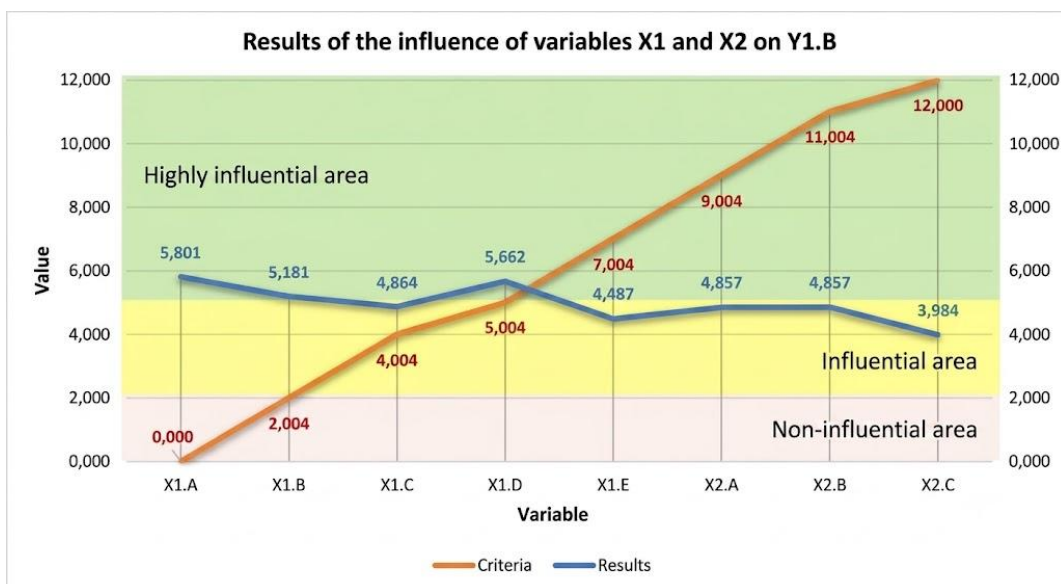


Source: Processed Data, 2026

Figure 2. Effect of Supply Chain Management (X_1) and Digitalism Supply Chain Management (X_2) on Project Schedule Performance ($Y_{1.A}$)

From a theoretical perspective, this study confirms that conventional Supply Chain Management practices and digital technologies complement one another in improving construction project performance. Effective digital transformation does not replace traditional SCM practices but strengthens coordination, communication, and information quality throughout the project lifecycle.

From a managerial perspective, the results suggest that construction organizations should continue investing in integrated digital procurement platforms while strengthening employee competencies through continuous training. Greater integration among Smart-GEP, ERP, and IOG E-Commerce can further improve procurement transparency, accelerate decision-making, minimize operational risks, and support project completion within planned schedule and budget. Such integration is particularly valuable for large-scale engineering projects requiring coordination among multiple stakeholders.



Source: Processed Data, 2026

Figure 3. Effect of Supply Chain Management (X_1) and Digitalism Supply Chain Management (X_2) on Project Schedule Performance ($Y_{1.B}$)

5. Conclusion and Suggestion

5.1 Conclusion

This study evaluated the effectiveness of Supply Chain Management (SCM) practices and Digitalism Supply Chain Management in improving project performance through the integration of Smart-GEP, Enterprise Resource Planning (ERP), and IOG E-Commerce in the Demineralized Facility Construction Project at ABC Field. The statistical results demonstrate that SCM Practices and Digitalism SCM simultaneously have a significant effect on project performance, particularly in relation to schedule and cost performance. The overall regression model was statistically significant ($F = 107.953$, $p < 0.001$) and explained approximately 79.7% of the variation in project performance ($R^2 = 0.797$), indicating strong explanatory capability of the proposed model.

Partially, Digitalism SCM showed a positive and statistically significant effect on project performance ($B = 0.852$; $\beta = 1.256$; $t = 14.594$; $p < 0.001$). This finding indicates that greater utilization of Smart-GEP, ERP, and IOG E-Commerce is associated with improved project performance through enhanced procurement transparency, information integration, real-time monitoring, and coordination of project resources. In contrast, SCM Practices exhibited a significant negative partial coefficient when analyzed simultaneously with Digitalism SCM ($B = -0.371$; $\beta = -0.786$; $t = -9.129$; $p < 0.001$). Therefore, the contribution of conventional SCM practices should not be interpreted as an independent positive effect within the simultaneous regression model, but rather in relation to the presence of integrated digital supply chain systems.

Overall, the findings demonstrate that the integration of digital technologies into supply chain processes is an important factor in improving project performance. Digitalism SCM strengthens the management of procurement, information, inventory, logistics, and coordination within the project environment. From a practical perspective, the results support the continued integration and optimization of Smart-GEP, ERP, and IOG E-Commerce as a strategic approach to improving schedule and cost performance in complex oil and gas construction projects.

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