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LOGISTICS AND DISTRIBUTION PRACTICES AND THE PERFORMANCE OF MANUFACTURING FIRMS: ESTABLISHING THE RELATIONSHIP AT PEARL DAIRY FARMS LIMITED, MBARARA, UGANDA

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ABSTRACT

This article reports findings on the third objective of a wider study that examined the relationship between supply chain management (SCM) practices and the performance of manufacturing firms, using Pearl Dairy Farms Limited (PDFL) in Mbarara, Uganda, as a case study. The specific objective addressed here was to establish the relationship between logistics and distribution practices and firm performance; two prior objectives, on procurement and sourcing management and on inventory management, have been reported elsewhere. Anchored on Systems Theory, the wider study adopted a cross-sectional design combining quantitative and qualitative approaches. A sample of 108 respondents was drawn from a target population of 150 using Krejcie and Morgan's (1970) table, comprising procurement officers, suppliers, distributors, an accountant, and administrative staff. Data were collected using a structured, five-point Likert-scale questionnaire and an interview guide, and analysed using Pearson correlation, multiple linear regression, and thematic analysis. Descriptively, logistics and distribution recorded an average mean of 3.92 (SD = 0.812), with distribution reliability and customer-facing outcomes rated highest and transportation systems rated lowest and most variably. Pearson correlation analysis revealed a strong, positive, and statistically significant relationship between logistics and distribution and firm performance ($r = 0.663$, $n = 108$, $p = 0.000$), and multiple regression analysis, with logistics and distribution entered alongside procurement and sourcing management and inventory management, showed that the three practices jointly explained 68.0% of the variance in firm performance ($R^2 = 0.680$, $F(3, 104) = 73.69$, $p = 0.000$), with logistics and distribution emerging as the second-strongest independent predictor ($B = 0.301$, $\beta = 0.329$, $t = 5.190$, $p < 0.001$), behind inventory management and ahead of procurement and sourcing management. Qualitative findings corroborated these results, with key informants attributing distribution reliability to dedicated cold-chain transport investment while identifying seasonal road conditions as the primary residual constraint. The study concludes that logistics and distribution is a strong, statistically significant, and strategically consequential driver of firm performance at PDFL, and recommends investment in route-optimisation technology and all-weather transport capacity, alongside government investment in rural road infrastructure.

Keywords: Logistics and Distribution, Firm Performance, Systems Theory, Supply Chain Management, Manufacturing Firms, Uganda.

1.0 INTRODUCTION

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Supply chain management (SCM) refers to the planning, implementation, and control of the operations of the supply chain with the aim of satisfying customer requirements in an efficient and cost-effective manner, encompassing procurement, inventory management, logistics, production, and distribution (Christopher, 2016). Within SCM, logistics and distribution ensure the efficient movement of raw materials and finished products across the supply chain, enabling firms to deliver products on time, reduce transportation costs, and improve customer satisfaction (Thomas, 2026). For manufacturing firms handling highly perishable products, professional logistics investment and cold-chain management are central to preserving product quality and, ultimately, to firm performance, which is typically measured across operational, financial, customer, and market dimensions (Kaplan & Norton, 1996).

In Uganda's dairy processing sub-sector specifically, industry reports indicate that raw milk wastage historically exceeded 50% prior to major processor interventions, a loss level attributable in large part to inadequate cold-chain logistics, seasonal sourcing volatility, and inconsistent inventory control (Dharmawan, 2026; Ajuna, 2020). Beyond wastage, dairy processors in the region continue to report recurrent stock-outs at distribution points, delayed deliveries to retail and wholesale channels, and limited supplier coordination, all of which directly erode customer satisfaction, revenue predictability, and market share (Christopher, 2018; Coleman, 2017). Pearl Dairy Farms Limited (PDFL), one of the leading dairy processors in Uganda, has responded by implementing a range of SCM interventions, including direct sourcing from over 12,000 smallholder farmers, the establishment of Milk Collection Centers, and investment in cold-chain logistics (Webber & Labaste, 2019; Jääskeläinen, 2018). However, while these interventions are documented in company records and prior descriptive accounts, the statistical magnitude and relative strength of the relationship between logistics and distribution practices specifically, and the firm's operational, financial, customer, and market performance had not been empirically tested using inferential methods.

It was against this background that the wider study from which this article is drawn examined the relationship between supply chain management practices and the performance of manufacturing firms, using PDFL as a case study. That study pursued three objectives: to examine the relationship between procurement and sourcing management and firm performance, to evaluate the relationship between inventory management and firm performance, and to establish the relationship between logistics and distribution practices and firm performance; the first two objectives have been reported elsewhere. This article addresses the third objective, namely, to establish the relationship between logistics and distribution practices and the performance of Pearl Dairy Farms Limited.

The study was anchored on Systems Theory, developed by Ludwig von Bertalanffy in the 1940s and 1950s, which views organisations as interconnected systems in which changes in one component affect the whole (Sheffi, 2023). Applied to PDFL, Systems Theory grounds the logistics and distribution variable specifically: it explains why disruptions in transportation reverberate across procurement, production, and customer service, and why holistic coordination, rather than departmental optimisation alone, drives firm-level performance (Drack & Pouvreau, 2025). Within this framework, logistics and distribution constitute the node connecting internal operations to the external market, such that the reliability of this node was expected to bear directly on customer satisfaction and market performance.

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Empirically, prior studies converge on the proposition that logistics and distribution efficiency enhance operational, customer, and market performance, but diverge sharply in context. Thomas (2026) found that logistics capabilities, process capability, flexibility, and information integration, improve operational efficiency and reduce disruption-related risk, but did not examine firms handling highly perishable products, where the cost of delay is materially different from durable-goods contexts. Diaz-Madroñero (2026) found that efficient logistics systems reduce wastage and distribution costs, but did not analyse logistics performance specifically within local, developing-economy dairy supply chains. Dharmawan (2026) demonstrated that innovative logistics technologies can optimise distribution in disaster-prone or remote regions, a useful but geographically distant parallel to PDFL's road-based distribution network in south-western Uganda, while Webber and Labaste (2019) found that efficient logistics improve market access and customer satisfaction in African agriculture broadly, offering the most directly relevant regional evidence, but at the level of value chains generally rather than a single dairy processor.

None of these studies examines logistics and distribution specifically within a single perishable-goods manufacturing firm using inferential statistics to quantify the relationship's strength relative to other SCM practices, leaving unresolved, for practitioners such as PDFL's management, whether transportation and distribution-channel investment should be prioritised ahead of, or alongside, inventory or procurement investment. This study addressed this gap directly by including logistics and distribution as a distinct predictor in a multiple regression model alongside procurement and inventory management, enabling a direct comparison of relative predictive strength, supplemented by qualitative evidence on transportation-related constraints from key informants. This article reports the evidence generated to address this objective, discusses the findings in relation to Systems Theory and prior empirical work, and draws conclusions and recommendations relevant to PDFL's management, policy makers, and future researchers.

2.0 MATERIALS AND METHODS

2.1 Research Design and Approach

This article is drawn from a wider study that examined the relationship between supply chain management practices and the performance of manufacturing firms, using Pearl Dairy Farms Limited as a case study. The specific analyses reported here relate to the study's third objective, which sought to establish the relationship between logistics and distribution practices and firm performance. The wider study adopted a cross-sectional research design, combining quantitative and qualitative approaches, to collect data from participants at a single point in time. This design permitted the researcher to establish statistically significant relationships and associations between logistics and distribution and firm performance through correlation and regression, but did not permit strong causal inference, since predictor and outcome data were collected simultaneously from the same respondents; accordingly, the language of "relationship," "association," and "predictive strength" is used in preference to causal language throughout.

2.2 Study Population, Sample Size, and Sampling Procedure

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The target population comprised 150 individuals directly involved in or knowledgeable about SCM practices at PDFL, including procurement officers, suppliers and distributors, an accountant, and administrative staff. The sample size was determined using Krejcie and Morgan's (1970) formula for determining sample size from a given population, $n = N / (1 + N(e)^2)$, where N = 150 and e = 0.05, yielding a sample of 108 respondents, a 72% sampling ratio. Purposive sampling was used to select procurement officers, the accountant, and administrative staff (n = 5), who also formed the qualitative interview sample, given their specialised, non-substitutable knowledge of SCM operations; simple random sampling was used to select 103 respondents from the 145 suppliers and distributors, using a numbered sampling frame and a random-number generator.

2.3 Data Collection Instruments

Quantitative data on logistics and distribution were collected from the 103 suppliers and distributors using Section D of a structured questionnaire, comprising five-point Likert-scale items (1 = Strongly Disagree to 5 = Strongly Agree) adapted from validated SCM-performance measurement scales (Christopher, 2016; Green, Zelbst, Meacham, & Bhadauria, 2018; Yazidi & Rana, 2025). Firm performance was measured using a composite Firm Performance Index comprising operational, financial, customer-satisfaction, and market-performance indicator items. Qualitative data were collected using an interview guide administered to the five purposively sampled key informants (three procurement officers, one accountant, one administrative staff member), comprising open-ended questions on logistics and distribution practices and their perceived relationship with firm performance.

2.4 Validity and Reliability

Content validity was established through expert review by the research supervisor and two academic staff members, yielding a Content Validity Index of 0.83, exceeding the generally accepted 0.70 threshold (Lawshe, 1975). Instrument reliability was assessed using Cronbach's alpha following a pilot test administered to 15 respondents outside the final sample; the logistics and distribution scale returned a coefficient of 0.79, exceeding the conventional acceptability threshold of 0.70 (Nunnally, 1978). A test-retest procedure conducted two weeks apart with the same pilot group further confirmed temporal stability across constructs (r = 0.76 to 0.84).

2.5 Data Analysis

Quantitative data were analysed using IBM SPSS Statistics. Descriptive statistics (frequencies, percentages, means, and standard deviations) summarised respondents' levels of agreement with each logistics and distribution item, interpreted against ranges adapted from Best (1977): 1.00–1.80 = Very Low; 1.81–2.60 = Low; 2.61–3.40 = Moderate; 3.41–4.20 = High; 4.21–5.00 = Very High. Pearson's Product-Moment Correlation Coefficient was computed to determine the strength, direction, and statistical significance of the relationship between logistics and distribution and firm performance, and Multiple Linear Regression Analysis was conducted with firm performance as the dependent variable and procurement and sourcing management, inventory management, and logistics and distribution as predictors, to determine the joint and relative predictive contribution of the three SCM practices. Before regression analysis, assumptions of normality, linearity, homoscedasticity, and multicollinearity (via Variance

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Inflation Factors, all below 3.0) were checked and satisfied. Qualitative data from interviews were transcribed and analysed using thematic analysis following Braun and Clarke's (2006) six-step framework, organised around the study's specific objectives and used to contextualise and triangulate the quantitative findings.

2.6 Ethical Considerations

The researcher adhered to standard ethical principles throughout the study, including voluntary participation, informed consent, and confidentiality of respondent identities. All respondents were assured that their data would be used solely for academic purposes, and no sensitive, personal, or provocative questions were asked. Qualitative interview participants were additionally assigned anonymised codes (Procurement Officer A, B, and C; Accountant; Administrative Staff) in reporting, in line with confidentiality undertakings.

3.0 RESULTS

This section presents findings on the relationship between logistics and distribution practices and the performance of Pearl Dairy Farms Limited.

3.1 Descriptive Findings on Logistics and Distribution

Respondents rated PDFL's logistics and distribution practices highly overall, with an average mean score of 3.92 (SD = 0.812) across the five items measured, a level identical to that recorded for inventory management and higher than that for procurement and sourcing management (M = 3.56). The majority of respondents, n = 88 (81.5%), agreed or strongly agreed that efficient logistics and distribution enhance customer satisfaction and market performance (M = 3.96), the highest-rated item in the construct, while a similarly large majority, n = 87 (80.5%), agreed or strongly agreed that distribution channels are efficient and reliable (M = 3.94). Transportation systems recorded the lowest, though still high, mean score (M = 3.85, SD = 0.795), with the highest neutral-response proportion in the construct (n = 19, 17.6%), suggesting comparatively greater uncertainty regarding transportation reliability, plausibly linked to seasonal road conditions.

3.2 Correlation between Logistics and Distribution and Firm Performance

A Pearson correlation analysis was conducted between procurement and sourcing management, inventory management, logistics and distribution, and firm performance. Table 1 presents the results.

Table 1: Pearson Correlation Coefficients Between SCM Practices and Firm Performance (N = 108)

Variable	Procurement & Sourcing	Inventory Mgt	Logistics & Distribution	Firm Performance
Procurement & Sourcing	1	0.420**	0.386**	0.581**
Inventory Management	0.420**	1	0.475**	0.712**
Logistics & Distribution	0.386**	0.475**	1	0.663**
Firm Performance	0.581**	0.712**	0.663**	1

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Note. **Correlation is significant at the 0.01 level (2-tailed). Source: Field Data, 2026.

As shown in Table 1, logistics and distribution showed a strong, positive, and statistically significant relationship with firm performance ($r = 0.663$, $n = 108$, $p = 0.000$). Since this coefficient falls within the 0.60–0.79 range, the findings indicate a strong positive relationship, with a coefficient of determination ($r^2 = 0.440$) indicating that logistics and distribution alone accounts for approximately 44.0% of the variance in firm performance, a stronger bivariate relationship than that recorded for procurement and sourcing management ($r = 0.581$) though weaker than that for inventory management ($r = 0.712$). The inter-correlations among the three predictors themselves ($r = 0.386$ to 0.475) were moderate, indicating that while the three SCM practices are related, they represent sufficiently distinct constructs to be entered simultaneously into a multiple regression model without excessive multicollinearity, a conclusion further confirmed by Variance Inflation Factor diagnostics (all VIF < 3.0).

3.3 Regression Analysis

To determine the joint and relative predictive contribution of the three SCM practices, a multiple linear regression analysis was conducted with firm performance as the dependent variable and procurement and sourcing management, inventory management, and logistics and distribution as predictors. Table 2 presents the ANOVA results, and Table 3 presents the regression coefficients.

Table 2: ANOVA for Regression of Firm Performance on SCM Practices

Source	Sum of Squares	df	Mean Square	F
Regression	36.632	3	12.211	73.69
Residual	17.238	104	0.166	
Total	53.870	107		

Note. $p = 0.000$. Dependent Variable: Firm Performance. Source: Field Data, 2026.

Table 3: Regression Coefficients for Predictors of Firm Performance

Predictor	B	Std. Error	Std. Beta	t	Sig.
(Constant)	0.512	0.187	–	2.738	0.007
Procurement and Sourcing Management	0.215	0.052	0.238	4.135	0.000
Inventory Management	0.398	0.061	0.410	6.525	0.000
Logistics and Distribution	0.301	0.058	0.329	5.190	0.000

Note. Dependent Variable: Firm Performance. Source: Field Data, 2026.

As shown in Tables 2 and 3, the overall regression model was statistically significant, $F(3, 104) = 73.69$, $p = 0.000$, and yielded $R = 0.825$ and $R^2 = 0.680$ (Adjusted $R^2 = 0.671$), indicating that the three SCM practices jointly explained approximately 68.0% of the variance in firm performance at PDFL, a substantial proportion that considerably exceeds the variance explained by any single predictor in the correlation analysis. Logistics and distribution emerged as the second-strongest, statistically significant predictor of firm performance ($B = 0.301$, $\beta =$

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0.329, t = 5.190, p < 0.001), behind inventory management (B = 0.398, β = 0.410, t = 6.525, p < 0.001) but ahead of procurement and sourcing management (B = 0.215, β = 0.238, t = 4.135, p < 0.001), indicating that for every one-unit increase in logistics and distribution practice, firm performance increased by 0.301 units, holding procurement and inventory management constant. This ranking, inventory management > logistics and distribution > procurement and sourcing management, mirrors the ranking obtained in the bivariate correlation analysis.

3.4 Qualitative Corroboration

Interviews with key informants corroborated and extended the quantitative findings. Regarding distribution reliability, Procurement Officer A explained: "We have our own refrigerated trucks for moving processed products to distributors. This was a big investment, but it means we are not depending on hired vehicles that might not have proper cooling. It has really improved how fast and how safely our products reach the market," directly supporting the quantitative finding that the majority of respondents (80.5%) rated distribution channels as efficient and reliable.

Consistent with the comparatively lower and more variable rating for transportation systems, the Administrative Officer identified road infrastructure as a persistent, largely exogenous challenge: "During the rainy season, some of the rural collection routes become very difficult. Trucks can get delayed for hours, and that affects our schedules both for collecting milk and for delivering finished products. It is one thing we cannot fully control because it depends on the roads, not just on us." This directly explains the elevated neutral-response rate (17.6%) recorded for the transportation item. Procurement Officer B further linked distribution reliability to competitive positioning: "Our distributors know that Lato Milk products will arrive on time and in good condition. That reliability is part of why they keep ordering from us instead of switching to competitors. Distribution is not just about moving products; it is part of how we compete in the market," reinforcing the finding that efficient logistics and distribution were most strongly associated with customer satisfaction and market performance.

On the relative importance of logistics compared with inventory management, informants themselves were divided: the accountant emphasised transportation risk ("if you cannot move the product, good inventory does not help you"), while Procurement Officer C emphasised inventory ("there is no amount of good procurement that fixes spoiled milk"), suggesting that PDFL's management should treat inventory and logistics investment as jointly, rather than independently, prioritised.

3.5 Summary of Findings

Taken together, the descriptive results, the Pearson correlation results (Table 1), the multiple regression results (Tables 2 and 3), and the corroborating qualitative evidence above provided converging evidence of a strong, positive, and statistically significant relationship between logistics and distribution practices and firm performance at Pearl Dairy Farms Limited, with logistics and distribution the second-strongest of the three SCM practices examined.

4.0 DISCUSSION

The third objective of this study sought to establish the relationship between logistics and distribution practices and firm performance. The findings revealed a strong, positive, and

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statistically significant relationship (r = 0.663, p = 0.000), and logistics and distribution emerged as the second-strongest predictor in the regression model (β = 0.329, p < 0.001). Descriptively, this construct recorded an average mean identical to inventory management (M = 3.92) but a marginally higher average standard deviation (SD = 0.812), with the transportation-systems item recording both the lowest mean (M = 3.85) and the highest neutral-response proportion (17.6%) within the construct.

This finding is consistent with Systems Theory's emphasis on the interdependence of supply-chain nodes: logistics and distribution constitute the node connecting internal operations to the external market, and the qualitative evidence shows that PDFL's investment in dedicated refrigerated transport has strengthened this node considerably, while seasonal road-infrastructure constraints, an external, non-managerial factor, remain the primary residual weakness, as the Administrative Officer's account of rainy-season delays illustrates. This finding both corroborates and qualifies Thomas (2026), who found that logistics capabilities improve operational efficiency: the present study confirms this relationship statistically while showing that, in the PDFL case, infrastructural rather than managerial-capability constraints account for most of the variability in transportation performance, a distinction Thomas (2026) did not examine.

The finding that logistics and distribution outperformed procurement, but was itself outperformed by inventory management, as a predictor of firm performance is a novel contribution relative to Webber and Labaste (2019) and Diaz-Madroñero (2026), neither of which statistically ranked SCM practices against one another. This ranking, corroborated qualitatively by informants' divided emphasis between transportation risk and inventory discipline, suggests that PDFL's management should treat inventory and logistics investment as jointly, rather than independently, prioritised, since either constraint alone can undermine performance in a highly perishable-product system.

5.0 CONCLUSION AND RECOMMENDATIONS

The study concludes that logistics and distribution has a strong, statistically significant, positive relationship with firm performance at Pearl Dairy Farms Limited (r = 0.663, β = 0.329), underpinned by the firm's investment in dedicated cold-chain transport, with seasonal road-infrastructure conditions constituting the primary residual constraint, one that is largely exogenous to PDFL's internal management practices. Jointly with procurement and sourcing management and inventory management, the three SCM practices explain 68.0% of the variance in firm performance (R^2 = 0.680), confirming that supply chain management is a substantial, statistically demonstrable driver of performance at PDFL, with inventory management and logistics and distribution together accounting for the greater share of this explanatory power relative to procurement and sourcing management.

Based on the finding that logistics and distribution is the second-strongest predictor of firm performance, and that transportation systems recorded the highest neutral-response rate in this construct, PDFL's management should invest in route-optimisation technology and expand all-weather-capable transport capacity to mitigate the rainy-season delays identified qualitatively. Given that seasonal road-infrastructure conditions were qualitatively and quantitatively identified as the primary residual constraint on logistics performance, an issue largely outside PDFL's direct control, local and national government authorities should prioritise investment

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in all-weather rural road infrastructure connecting dairy-producing areas to processing facilities in the Mbarara region, in support of the agro-processing objectives of national development frameworks.

Because this study's cross-sectional design established correlational rather than causal associations, future researchers should employ longitudinal or quasi-experimental designs to test whether the relationship between logistics and distribution and firm performance identified here holds causally over time, and should examine the role of external factors, such as government infrastructure investment, as moderators of the logistics-performance relationship, given this study's qualitative finding that infrastructural constraints, rather than managerial practice, account for much of the residual variability in logistics performance. Comparative studies across multiple manufacturing sub-sectors in Uganda, both perishable-goods and non-perishable-goods, would further help establish whether the relative predictive ranking of logistics and distribution found in this study is specific to perishability or generalises more broadly.

Consent for Publication

All authors consented and approved the manuscript to be submitted for publication.

Availability of Data and Materials

The data supporting the findings of this article are available from the corresponding author upon reasonable request, subject to Pearl Dairy Farms Limited's data-sharing agreements.

Competing Interests

The authors declare no competing interests.

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Authors' Contributions

Aine Brian conceptualised the study, collected and analysed the data, and prepared the original draft of the manuscript. Ogaba Ariyo and Aryatwijuka Wilbroad supervised the study and reviewed and edited the manuscript. All authors read and approved the final manuscript.

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