



# ENHANCING OPERATIONAL EFFICIENCY AND SUPPLY CHAIN RESILIENCE IN THE FISH PROCESSING INDUSTRY: AN EMPIRICAL INVESTIGATION WITH SPECIAL REFERENCE TO NYANZA PERCH LTD, UGANDA

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## ABSTRACT

The fish processing industry represents a critical component of global food systems and export-oriented economic development, particularly in emerging economies. However, operational inefficiencies and supply chain disruptions continue to challenge organizational sustainability due to the perishable nature of fish products, logistics constraints, and inadequate cold chain infrastructure. This study investigates operational efficiency and supply chain challenges in the fish processing industry with special reference to Nyanza Perch Ltd, Uganda. The study aims to evaluate operational practices, identify major supply chain bottlenecks, and propose strategic measures for improving organizational performance and resilience.

A descriptive and analytical research design was adopted. Primary data were collected from 120 employees using a structured questionnaire based on a five-point Likert scale. Secondary data were obtained from journals, industry reports, and company documents. Statistical tools including descriptive statistics, correlation analysis, Chi-square test, regression analysis, and ANOVA were employed using SPSS software.

The findings reveal that labour utilization, productivity, wastage control, and time management significantly influence operational efficiency. Regression analysis confirms that operational variables explain 86.5% of operational efficiency outcomes ( $R^2 = 0.865$ ), while supply chain variables explain 79.8% of organizational performance outcomes ( $R^2 = 0.798$ ). Transportation delays, raw material shortages, and cold chain maintenance issues emerged as major operational barriers. The study concludes that integrated supply chain systems, digital transformation, cold chain modernization, and lean operational strategies are essential for improving operational sustainability and competitiveness.

**KEYWORDS:** Operational Efficiency; Fish Processing Industry; Supply Chain Management; Cold Chain Logistics; Labour Productivity; Inventory Management; Digital Transformation; Fisheries Supply Chain; Lean Operations; Organizational Performance

## 1. INTRODUCTION

The fish processing industry has become increasingly important in global trade, employment generation, and food security. Rapid urbanization, increasing protein consumption, and globalization of seafood markets have significantly expanded the demand for processed fish products. Consequently, operational efficiency and supply chain resilience have become essential determinants of competitiveness within the fisheries sector.

Operational efficiency refers to the ability of an organization to optimize labour, machinery, inventory, processing time, and resource utilization to maximize productivity while minimizing costs and wastage. In fish processing industries, operational effectiveness is particularly critical because fish products are highly perishable and vulnerable to spoilage during procurement, transportation, processing, and storage activities.

Supply chain management plays a strategic role in ensuring smooth coordination between procurement,

transportation, inventory management, processing, packaging, and export distribution. Inefficiencies in cold chain logistics, transportation systems, and inventory management can severely affect product quality, customer satisfaction, and organizational profitability.

Uganda's fisheries sector contributes substantially to national economic growth through export earnings and employment opportunities. Nyanza Perch Ltd is among the leading fish processing firms engaged in processing and exporting Nile perch products to international markets. Despite possessing modern facilities, the organization continues to encounter operational and supply chain challenges related to raw material procurement, cold chain systems, logistics costs, and transportation delays.

This study therefore examines operational efficiency and supply chain resilience within the organization using empirical and statistical analysis.



## 2. OBJECTIVES OF THE STUDY

1. To evaluate operational efficiency within the organization.
2. To identify major supply chain challenges affecting operational performance.
3. To analyze relationships among operational variables.
4. To examine the impact of supply chain variables on organizational performance.
5. To recommend strategies for improving operational efficiency and supply chain resilience.

## 3. HYPOTHESES OF THE STUDY

### H1

There is a significant positive relationship between labour utilization, productivity, wastage control, and time management.

### H2

Operational variables significantly influence operational efficiency.

### H3

Supply chain challenges significantly affect organizational performance.

### H4

There is no significant difference in technology adoption across departments.

## 4. RESEARCH METHODOLOGY

| Particulars          | Description                                                     |
|----------------------|-----------------------------------------------------------------|
| Research Design      | Descriptive and Analytical                                      |
| Data Type            | Primary and Secondary                                           |
| Sample Size          | 120 Respondents                                                 |
| Sampling Technique   | Simple Random Sampling                                          |
| Data Collection Tool | Structured Questionnaire                                        |
| Scale Used           | Five-Point Likert Scale                                         |
| Statistical Software | SPSS                                                            |
| Statistical Tools    | Percentage Analysis, Correlation, Regression, ANOVA, Chi-square |

## 5. DEMOGRAPHIC ANALYSIS

Table 1: Gender Distribution

| Gender | Frequency | Percentage |
|--------|-----------|------------|
| Male   | 64        | 53.3       |
| Female | 56        | 46.7       |
| Total  | 120       | 100        |

### Interpretation

The workforce composition indicates balanced gender participation, enhancing workforce diversity and organizational inclusivity.

Table 2: Age Distribution

| Age Group      | Frequency | Percentage |
|----------------|-----------|------------|
| 18–25 Years    | 22        | 18.3       |
| 26–35 Years    | 29        | 24.2       |
| 36–45 Years    | 20        | 16.7       |
| 46–55 Years    | 28        | 23.3       |
| Above 55 Years | 21        | 17.5       |

### Interpretation

The majority of employees belong to the experienced age groups, indicating organizational stability and operational expertise.

Table 3: Educational Qualification

| Qualification              | Frequency | Percentage |
|----------------------------|-----------|------------|
| Diploma                    | 28        | 23.3       |
| Undergraduate              | 31        | 25.8       |
| Postgraduate               | 35        | 29.2       |
| Professional Qualification | 26        | 21.7       |

### Interpretation

The findings reveal that the organization possesses a relatively qualified workforce capable of managing technical and operational activities effectively.

## 6. OPERATIONAL EFFICIENCY ANALYSIS

Table 4: Labour Utilization Efficiency

| Response          | Frequency | Percentage |
|-------------------|-----------|------------|
| Strongly Agree    | 28        | 23.3       |
| Agree             | 45        | 37.5       |
| Neutral           | 25        | 20.8       |
| Disagree          | 15        | 12.5       |
| Strongly Disagree | 7         | 5.9        |

### Interpretation

Approximately 61% of respondents agreed that labour utilization is effective, indicating efficient workforce management practices.

Table 5: Productivity Level Assessment

| Response          | Frequency | Percentage |
|-------------------|-----------|------------|
| Strongly Agree    | 30        | 25.0       |
| Agree             | 47        | 39.2       |
| Neutral           | 23        | 19.2       |
| Disagree          | 13        | 10.8       |
| Strongly Disagree | 7         | 5.8        |

### Interpretation

The majority of respondents perceived productivity levels as high, demonstrating operational effectiveness within processing activities.

Table 6: Wastage Control Effectiveness

| Response          | Frequency | Percentage |
|-------------------|-----------|------------|
| Strongly Agree    | 24        | 20.0       |
| Agree             | 46        | 38.3       |
| Neutral           | 29        | 24.2       |
| Disagree          | 14        | 11.7       |
| Strongly Disagree | 7         | 5.8        |

### Interpretation

The organization demonstrates moderate effectiveness in wastage control, although further process optimization remains necessary.



## 7. SUPPLY CHAIN CHALLENGES ANALYSIS

Table 7: Transportation Delay Challenges

| Response          | Frequency | Percentage |
|-------------------|-----------|------------|
| Strongly Agree    | 31        | 25.8       |
| Agree             | 49        | 40.8       |
| Neutral           | 20        | 16.7       |
| Disagree          | 13        | 10.8       |
| Strongly Disagree | 7         | 5.9        |

### Interpretation

Transportation delays significantly affect operational continuity and product freshness within the organization.

Table 8: Cold Chain Maintenance Challenges

| Response          | Frequency | Percentage |
|-------------------|-----------|------------|
| Strongly Agree    | 27        | 22.5       |
| Agree             | 46        | 38.3       |
| Neutral           | 25        | 20.8       |
| Disagree          | 15        | 12.5       |
| Strongly Disagree | 7         | 5.9        |

### Interpretation

Cold chain management challenges remain a critical operational concern affecting product quality and inventory preservation.

## 8. CORRELATION ANALYSIS

Table 9: Correlation Matrix

| Variables          | Labour Utilization | Productivity | Wastage Control | Time Management |
|--------------------|--------------------|--------------|-----------------|-----------------|
| Labour Utilization | 1.000              | 0.601**      | 0.552**         | 0.630**         |
| Productivity       | 0.601**            | 1.000        | 0.584**         | 0.624**         |
| Wastage Control    | 0.552**            | 0.584**      | 1.000           | 0.666**         |
| Time Management    | 0.630**            | 0.624**      | 0.666**         | 1.000           |

Significant at  $p < 0.01$

### Interpretation

The results reveal strong positive relationships among operational variables, confirming that effective labour

utilization, productivity, wastage reduction, and time management collectively improve operational performance.

## 9. REGRESSION ANALYSIS

Table 10: Regression Model Summary

| Model                        | R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | Std. Error |
|------------------------------|-------|----------------|-------------------------|------------|
| Operational Efficiency Model | 0.930 | 0.865          | 0.861                   | 0.317      |

### Interpretation

The model explains 86.5% of the variation in operational efficiency, indicating strong predictive capability.

Table 11: ANOVA Results

| Source     | Sum of Squares | df  | Mean Square | F       | Sig.  |
|------------|----------------|-----|-------------|---------|-------|
| Regression | 74.531         | 3   | 24.844      | 247.908 | 0.000 |
| Residual   | 11.621         | 116 | 0.100       |         |       |
| Total      | 86.152         | 119 |             |         |       |

### Interpretation

The regression model is statistically significant, confirming that operational variables significantly affect operational efficiency.

Table 12: Regression Coefficients

| Variables          | Beta  | t-value | Significance |
|--------------------|-------|---------|--------------|
| Labour Utilization | 0.304 | 5.612   | 0.000        |
| Wastage Control    | 0.420 | 7.148   | 0.000        |
| Time Management    | 0.346 | 6.021   | 0.000        |

### Interpretation

Wastage control emerged as the strongest determinant of operational efficiency.

## 10. SUPPLY CHAIN REGRESSION ANALYSIS

Table 13: Supply Chain Model Summary

| Model                          | R     | R <sup>2</sup> | Adjusted R <sup>2</sup> |
|--------------------------------|-------|----------------|-------------------------|
| Supply Chain Performance Model | 0.893 | 0.798          | 0.791                   |

### Interpretation

Supply chain variables explain approximately 79.8% of organizational performance variation.



## 11. MAJOR FINDINGS

1. Labour utilization significantly improves productivity.
2. Effective time management enhances operational efficiency.
3. Transportation delays remain a major operational bottleneck.
4. Cold chain maintenance challenges affect product quality.
5. Wastage control is the strongest determinant of efficiency.
6. Digital technologies positively influence operational performance.
7. Supply chain coordination significantly improves organizational effectiveness.

## 12. MANAGERIAL IMPLICATIONS

The study highlights the strategic importance of lean operational systems, digital transformation, and supply chain integration in fish processing industries. Managers should prioritize cold chain modernization, transportation optimization, and waste reduction initiatives to improve competitiveness and export performance.

## 13. RECOMMENDATIONS

1. Upgrade cold storage infrastructure.
2. Implement ERP and digital inventory systems.
3. Strengthen supplier coordination networks.
4. Adopt lean manufacturing practices.
5. Improve workforce technical training.
6. Enhance logistics and transportation planning.
7. Introduce automated monitoring technologies.

## 14. CONCLUSION

The study concludes that operational efficiency and supply chain resilience are critical determinants of

organizational sustainability in the fish processing industry. Operational variables such as labour utilization, time management, and wastage control significantly improve productivity and efficiency outcomes. Simultaneously, supply chain challenges including transportation delays, cold chain disruptions, and logistics costs continue to affect operational continuity.

The findings emphasize the necessity of integrated operational strategies, digital transformation, and cold chain modernization for achieving long-term sustainability and global competitiveness.

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