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# Determinants of Labor Performance and Environmental Sustainability in Coastal Shrimp Farming Systems: A Case Study from Ecuador

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## ABSTRACT
The performance and growth of aquaculture export companies are increasingly linked not only to worker productivity but also to the environmental sustainability of coastal aquatic systems. Shrimp farming in Ecuador, concentrated in hydrologically sensitive coastal zones, represents a strategic agro-industrial activity with both economic and ecological significance. This study evaluates labor performance within the shrimp farming sector through a validated psychosocial model, using exploratory and confirmatory factor analysis with 250 workers. The integrated model includes job satisfaction, organizational commitment, working conditions, and productivity—constructs with high internal consistency (Cronbach's alpha: 0.766–0.861). Confirmatory analysis revealed excellent model fit (CFI = 0.985; RMSEA = 0.073). Findings suggest that psychosocial well-being significantly contributes to sustainable labor practices in aquaculture systems facing environmental stress and water management challenges. This model may serve as a practical tool for improving productivity and sustainability in shrimp farming and other coastal aquaculture industries.

## INTRODUCTION

*Litopenaeus vannamei*, *Litopenaeus vannamei*, commonly known as the whiteleg shrimp, is one of the most economically important aquatic species cultivated worldwide, particularly in tropical and subtropical regions **(Valenzuela *et al.*, 2019)**. Ecuador ranks among the top global exporters of farmed shrimp, representing a critical aquaculture sector that directly supports over 250,000 jobs and contributes significantly to the country's GDP and trade balance **(FAO, 2023; Ministerio de Producción, 2024)**. Shrimp farming is concentrated in coastal zones that are hydrologically vulnerable and ecologically sensitive, often overlapping with mangrove ecosystems and estuarine habitats. This dual economic and ecological importance has placed increasing pressure on the industry to implement sustainable production practices that integrate environmental stewardship with responsible labor management **(Guevara-Viejó *et al.*, 2021; Valenzuela-Cobos *et al.*, 2022)**.

Despite its global leadership, the Ecuadorian shrimp sector faces multiple challenges, including market fluctuations, increasing demands for product traceability, and compliance with international sustainability standards (e.g., BAP, ASC) **(Sánchez-Hernández *et al.*, 2019)**. These pressures underscore the critical need for efficient human capital management. Shrimp farming operations are labor-intensive, requiring specialized technical knowledge, exposure to extreme environmental conditions, and continuous occupational training—factors that directly impact productivity and worker well-being **(Alles, 2017)**. In this context, sustainability is defined not only by water quality and ecological footprint but also by the psychosocial dynamics within the labor force. Working in estuarine or pond-based systems implies exposure to heat, humidity, and physically demanding tasks, making labor performance evaluation a central concern for both operational efficiency and social responsibility.

Given this context, the following research hypotheses are proposed:

**H1.** Job satisfaction positively influences the job performance of workers in the shrimp farming sector.

**H2.** Working conditions directly affect workers' job performance.

**H3.** Labor productivity has a positive relationship with job performance.

**H4.** Job performance improves with organizational commitment.

Several studies have addressed labor performance in aquaculture and similar agro-industrial settings. **Panjaitan and Sihombing (2021)** proposed performance evaluation models based on multi-criteria analysis. While **Aggarwal and Mitra Thakur (2013)** emphasized participatory approaches adapted to the needs of specific productive sectors. **Singh and Khatri (2023)** argued that job satisfaction directly influences organizational productivity by improving working conditions, professional growth, and supervision. Similarly, **Chiang and Hsieh (2012)** and **Kustinah *et al.* (2021)** showed that employees' confidence in their skills reduces uncertainty and enhances performance. These theoretical and empirical contributions highlight the necessity for evaluation models tailored to the specific characteristics of each industry **(Awang, 2010; Yirenkyi Fianko, 2012)**.

While previous research has contributed to our understanding of job performance, many models do not adequately incorporate the psychosocial dimensions or working conditions specific to aquaculture operations. Moreover, existing approaches—whether purely quantitative or participatory without rigorous validation—do not fully capture the complexity of performance drivers in environmentally sensitive coastal industries. In response, mixed-method models have gained prominence, integrating quantitative and qualitative approaches to provide a more comprehensive understanding **(Christ, 2007; Pereira Pérez, 2011)**. Since the 1990s, these approaches have been applied across various disciplines, including education, medicine, and environmental psychology, offering valuable insights into human-centered phenomena in complex systems.

In this study, the quantitative phase involved exploratory factor analysis (EFA) to identify key dimensions influencing labor performance, followed by confirmatory factor

analysis (CFA) using IBM SPSS AMOS to validate the model structure. In parallel, structured interviews were conducted with shrimp farm workers to contextualize the findings and capture their perceptions regarding job satisfaction, workplace conditions, and organizational support **(Hair, 2014)**. This methodological triangulation is particularly relevant in labor-intensive aquaculture settings, where both human and environmental variables affect productivity and sustainability outcomes.

Accordingly, this research focuses on shrimp farming operations in the province of Guayas, Ecuador—a region with high aquaculture density and exposure to environmental stressors such as water salinity, temperature fluctuations, and mangrove degradation. The main objective is to assess labor performance in the shrimp farming sector through a validated, integrated model using a mixed-methods approach. This allows for a better understanding of how psychosocial well-being influences sustainable productivity, and how such models can support both internal management strategies and broader environmental goals.

The key contribution of this study lies in the adaptation of an integrated psychosocial model to the shrimp aquaculture context, accounting for its unique socioeconomic and ecological dynamics. Unlike generic performance models, this framework addresses sector-specific working conditions, training demands, and environmental constraints. The findings can inform companies in designing more effective labor management strategies, enhancing worker motivation and retention, and supporting environmentally responsible practices in ecologically vulnerable coastal regions.

## LITERATURE REVIEW

### 1. Job satisfaction and job performance

Job satisfaction is a key concept in organizational management, defined in various ways. **Kianto *et al.* (2016)** considered it the result of personal factors and daily attitudes, while **Wood and Locke,** cited in **Kianto *et al.* (2016)** described it as a general attitude toward work and the emotional perception of the work experience. Likewise, **Clark,** cited in **Wood (1990)** argued that higher job satisfaction strengthens employee loyalty and improves service quality.

Job satisfaction is also defined as the emotional evaluation of work **(Clark, 1997)** or as the perception of working conditions and organizational reputation **(Atmojo, 2012; Bin, 2016)**. Job satisfaction and job performance are closely linked, as higher levels of satisfaction generate a positive environment that favors productivity and the achievement of organizational goals **(Raziq & Maulabakhsh, 2015)**. Satisfied employees show higher motivation, lower turnover intention, and better performance levels **(Heskett, 1994; Singh & Khatri, 2023)**.

Various studies have shown that factors such as salary, working conditions, growth opportunities, and interpersonal relationships influence job satisfaction, which in turn

impacts job performance **(Kianto *et al.*, 2016; Mathieu *et al.*, 2016)**. In addition, job satisfaction promotes service quality and organizational commitment, improving efficiency and overall results **(Steers, 1987)**. These dynamics are particularly relevant in labor-intensive sectors such as shrimp farming, where harsh working conditions and long shifts require high emotional resilience and job satisfaction to sustain performance.

**2. Job status, working conditions, and job performance**

Business performance is often measured by financial indicators, but it is equally important to evaluate factors such as satisfaction, motivation, and absenteeism, as they influence organizational efficiency **(Osman *et al.*, 2016; Nilsen & Ringholm, 2019)**. A suitable work environment enables employees to perform effectively and maintain the company's competitiveness **(Imran, 2012)**.

Working conditions directly affect the physical and mental well-being of employees **(Baruch-Feldman *et al.*, 2002)**. An inadequate environment can lead to burnout, stress, and health problems, reducing job satisfaction and performance **(Gulliver *et al.*, 2003; Rossberg *et al.*, 2004)**. Moreover, poor working conditions increase staff turnover and decrease productivity **(Mustafa & Ali, 2019)**.

Conversely, a favorable environment improves workers' attitudes and performance **(Day & Bedeian, 1991)**. Motivation—especially through recognition—reinforces an employee's sense of worth and contributes to both satisfaction and performance. The Job Characteristics Model (JCM) argues that working conditions fostering motivational qualities lead to better performance outcomes.

In shrimp aquaculture, working conditions often include exposure to high humidity, long hours in pond areas, and physically demanding tasks—factors that significantly affect workers' physical and psychological well-being.

**3. Labor productivity and job performance**

Labor productivity reflects the efficiency with which resources are used to generate goods or services and is a key indicator of competitiveness and organizational performance **(Hunt, 2000; Luzuriaga-Amador *et al.*, 2025)**. Measuring productivity enables evaluation of operational effectiveness and analysis of its evolution over time.

Job performance, on the other hand, refers to employees' actions and behaviors that impact organizational objectives. It is assessed through individual competencies and their contribution to the company, considering not only results but also alignment with effective work processes **(Stoner, 1996)**.

There is a direct relationship between productivity and job performance, as high individual performance leads to more efficient resource use and, consequently, higher productivity. Optimizing work processes, improving competencies, and aligning tasks with organizational objectives enhance operational efficiency and business competitiveness.

## 4. Organizational commitment and job performance

Organizational commitment is a key determinant of job performance and has been extensively studied in sociology and industrial psychology. It is considered a strong predictor of employee turnover and an indicator of organizational effectiveness, as it influences loyalty, identification with the company, and the effort employees invest to achieve its goals **(Heskett, 1994)**.

According to **Pelit *et al.* (2015)**, committed employees identify with organizational values, which motivates them to perform more effectively. Furthermore, organizational commitment predicts employees' intention to remain in the company more accurately than job satisfaction, making it an essential factor for workforce stability and performance **(Ayazlar & Güzel, 2014)**. Strong organizational connections also reduce absenteeism, strengthen cooperation, and reinforce corporate culture—facilitating the achievement of strategic objectives **(Heskett, 1994)**.

**Mohammed and Eleswed** cited in **Mohammed (2013)** define organizational commitment as the degree to which individuals adopt the company's values and objectives, identifying with them while fulfilling their responsibilities. **Azeem, (2010)** and **Al Zefeiti and Mohamad (2017)** emphasized that a strong belief in these values, along with the desire to stay in the organization and the willingness to exert effort, motivates employees to improve their performance.

Similarly, **Ling and Bhatti** cited in **Ling (2014)** argued that job performance is shaped by organizational recognition of employees' efforts and skills, which is influenced by working conditions. Strong commitment to the company and psychological attachment generate better performance outcomes **(Sharma, 2015; Al Zefeiti & Mohamad, 2017)**. From this perspective, organizational commitment is a manifestation of loyalty and effort within the social system, which boosts employee morale and productivity **(Jayaweera, 2015; Platis *et al.*, 2015)**.

Work performance—an essential parameter in organizational management—is closely linked to the search for innovative strategies for continuous improvement **(Aboazoum, 2015)**. In this sense, organizational commitment positively influences performance, as motivated employees aligned with the company's values tend to achieve higher levels of productivity and efficiency.

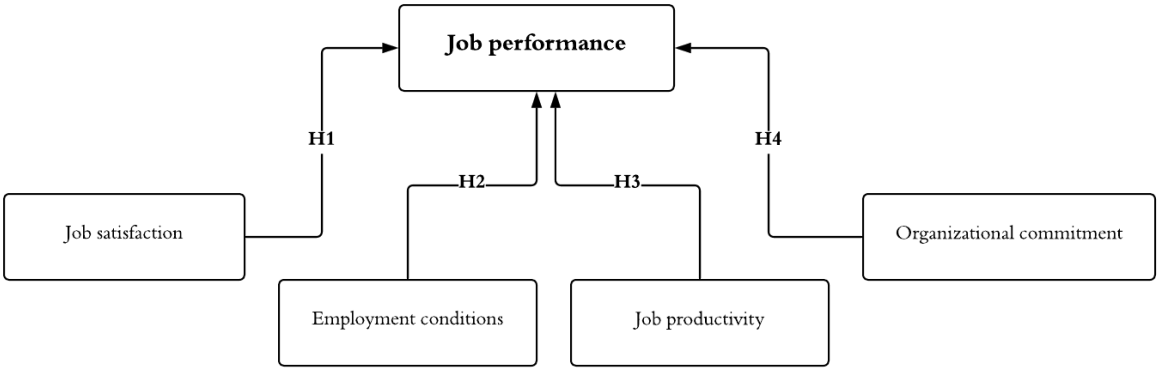


**Fig. 1.** Schematic view of the research model

## MATERIALS AND METHODS

### 1. Study design

This study employed a descriptive research design with a mixed-methods approach (qualitative and quantitative) to analyze labor performance in the shrimp farming industry. Combining these methods allowed for a comprehensive understanding of the phenomenon, integrating both the subjective perceptions of workers and objective, quantifiable data regarding the factors influencing their job performance. This approach is particularly relevant in labor-intensive aquaculture operations that involve exposure to challenging environmental conditions and repetitive physical tasks.

### 2. Sample and population

The study population consisted of 250 workers from various roles within shrimp farming operations in coastal Ecuador, who participated on a voluntary basis. Data collection was conducted between August 2024 and November 2024 through the human resources departments of aquaculture facilities. To facilitate participation, an online survey was distributed using the Google Forms platform. The estimated time to complete the survey ranged from 10 to 15 minutes.

### 3. Instrument

Respondents answered demographic questions, including age, gender, educational level, years of experience in aquaculture, and tenure within their current company. Subsequently, a structured questionnaire comprising 13 items was applied, organized into four key dimensions: job satisfaction, working conditions, labor productivity, and organizational commitment, aimed at assessing their impact on employees' job performance. A 5-point Likert scale was used to collect the responses.

For job satisfaction, the instrument developed by **Yan *et al.* (2022)** was applied, which has been previously validated and proven reliable. This dimension included three subclusters: salary satisfaction, satisfaction with job content, and satisfaction with coworker relationships.

To assess organizational commitment, the widely used scale developed by **Meyer and Allen (1997)** was employed. For this study, the Spanish version translated and adapted by **Arciniega and González (2006)** was used, having shown adequate psychometric properties in previous research among Spanish-speaking populations. This dimension

covered three components: affective commitment, continuance commitment, and normative commitment. Both the job satisfaction and organizational commitment dimensions used a 5-point Likert scale ranging from 1 ("Strongly disagree") to 5 ("Strongly agree").

The analysis of working conditions was conducted using a questionnaire with four subdimensions: safety, hygiene, ergonomics, and psychosocial factors. Given the diversity of occupational hazards in aquaculture—including prolonged exposure to humidity, slippery surfaces, and repetitive manual handling—a committee of experts selected the most relevant items based on the methodological proposal of **Benavides *et al.* (2016)**, developed for future Surveys on Working Conditions, Employment, and Health in Latin America and the Caribbean (CTESLAC).

Labor productivity was measured using the questionnaire from **Foro Europeo (2017)**, organized into three clusters: time management and planning, execution and focus on results, and problem-solving and decision-making. These two dimensions used a 5-point Likert-type scale ranging from 1 ("Never") to 5 ("Always").

### 4. Data analysis

To validate the structure of the model, a Confirmatory Factor Analysis (CFA) was conducted using IBM SPSS AMOS, version 23, providing a detailed approach to construct validity and reliability **(Carvajal-Morales *et al.*, 2024)**. Data analysis was performed with the Statistical Package for the Social Sciences (SPSS), a tool widely recognized for its precision in analyzing large datasets. Factor analysis was applied, as this method is appropriate for datasets with sample sizes of $n \geq 5$ **(Hair, 2014)**, ensuring rigor and consistency in the results **(Buglear, 2007)**.

Additionally, R Studio software, version 2024.12.1, was used to calculate composite reliability and average variance extracted (AVE).

## RESULTS

### 1. Profile of respondents' data analysis technique

The survey results indicate a predominance of male participants, with 73.20% identifying as male and 26.80% as female. The largest age group was 26–35 years (25.60%), followed by 36–45 years (24.40%) and 46–55 years (22.40%). Regarding educational attainment, most respondents had completed high school (36.80%), while 19.60% held a university degree, suggesting an overall moderate educational level within the workforce.

In terms of professional experience in the aquaculture sector, 26.80% of respondents reported more than 20 years of experience, whereas 12.40% had between 1 and 5 years. This distribution reflects a diverse range of seniority levels among workers. Regarding tenure within their current company, 35.20% had worked between 1 and 5 years,

26.80% between 6 and 10 years, 16.80% between 11 and 15 years, 12.80% between 16 and 20 years, and 8.40% had over 20 years of service (Table 1).

Overall, this demographic profile is consistent with labor structures typically found in shrimp farming operations, which often employ male-dominated workforces spanning a broad range of ages and experience levels in physically demanding coastal environments.

**Table 1.** Descriptive demographic statistics of the workers: gender, age, educational level, years of experience in agriculture and time working in the company

| Category | Factor | Frequency | Percentage |
|---|---|---|---|
| **Gender** | Male | 183 | 73.20 |
| | Female | 67 | 26.80 |
| **Age** | 18 - 25 | 50 | 20.00 |
| | 26 - 35 | 64 | 25.60 |
| | 36 - 45 | 61 | 24.40 |
| | 46 - 55 | 56 | 22.40 |
| | >56 | 19 | 7.60 |
| **Level of education** | No education | 29 | 11.60 |
| | Primary school | 46 | 18.40 |
| | High school | 92 | 36.80 |
| | Third level | 49 | 19.60 |
| | Technologist | 34 | 13.60 |
| **Years of experience in agriculture** | 1 - 5 | 31 | 12.40 |
| | 6 - 10 | 51 | 20.40 |
| | 11 - 15 | 46 | 18.40 |
| | 16 - 20 | 55 | 22.00 |
| | >20 | 67 | 26.80 |
| **Years working in the company** | 1 - 5 | 88 | 35.20 |
| | 6 - 10 | 67 | 26.80 |
| | 11 - 15 | 42 | 16.80 |
| | 16 - 20 | 32 | 12.80 |
| | >20 | 21 | 8.40 |

## 2. Exploratory factor analysis

To assess construct validity, the unweighted least squares method was applied to perform the exploratory factor analysis (EFA). The factorial matrix, obtained through Varimax rotation with Kaiser normalization, identified four factors—Job Satisfaction, Organizational Commitment, Working Conditions, and Labor Productivity—that together explained 55.64% of the total variance.

The internal consistency of each factor was evaluated using Cronbach's alpha, yielding the following values: Job Satisfaction ($\alpha = 0.809$), Organizational Commitment ($\alpha = 0.839$), Working Conditions ($\alpha = 0.861$), and Labor Productivity ($\alpha = 0.766$). All values exceeded the recommended threshold of 0.70, indicating excellent reliability.

Furthermore, all items exhibited factor loadings above 0.40, confirming their relevance within their respective factors. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.947, and Bartlett's test of sphericity was statistically significant, confirming that the data were suitable for factor analysis (Table 2).

**Table 2.** Exploratory factor analysis (Rotated factor matrix)

| Item | Factor | | | |
|---|---|---|---|---|
| | **Organizational Commitment** | **Labor Conditions** | **Job Satisfaction** | **Labor Productivity** |
| **SL1** | | | 0.725 | |
| **SL2** | | | 0.570 | |
| | | | | |
| **SL3** | | | 0.738 | |
| **CO1** | 0.626 | | | |
| **CO2** | 0.780 | | | |
| **CO3** | 0.759 | | | |
| **CL1** | | 0.617 | | |
| **CL2** | | 0.573 | | |
| **CL3** | | 0.543 | | |
| **CL4** | | 0.765 | | |
| **PL1** | | | | 0.638 |
| **PL2** | | | | 0.823 |
| **PL3** | | | | 0.713 |
| **Alfa de Cronbach** | 0.839 | 0.861 | 0.809 | 0.766 |

*Note: SL: Job satisfaction; CO: Organizational commitment; CL: Labor conditions; PL: Labor productivity*

### 3. Confirmatory factor analysis

Following the exploratory factor analysis (EFA), a rigorous instrument development and validation process was undertaken to ensure the quality and accuracy of the measures used in this study. First, an exhaustive literature review was conducted to identify and select the most relevant and widely validated instruments for inclusion in the survey. Subsequently, a series of statistical analyses was performed to evaluate the reliability and validity of each construct.

The EFA results provided the structural foundation for the next validation step. Accordingly, a Confirmatory Factor Analysis (CFA) was conducted using IBM SPSS AMOS, version 23, to examine the dimensional structure of the model (see Table 3). Model

fit was assessed using seven indices that evaluate discrepancy, incremental fit, and parsimony-adjusted measures, confirming the robustness of the results obtained.

**Table 3.** Model fit indices

| Fit measures | Index | Value | Recommended value |
|---|---|---|---|
| **Discrepancy measure** | CMIN/DF | 1.467 | (<2) |
| | Root Mean Square Error of the Approximation (RMSEA) | 0.973 | (0–0.1) |
| **Incremental adjustment measures** | Comparative Fit Index (CFI) | 0.985 | [0.9–1] |
| | Normed Fit Index (NFI) | 0.955 | [0.9–1] |
| | Tucker-Lewis Index (TLI) | 0.977 | (0.9–1) |
| | Incremental Fit Index (IFI) | 0.985 | (0.9–1) |
| **Parsimony-adjusted measures** | Parsimony-Adjusted Measures (PCFI) | 0.639 | (0.5–1) |

As a result of the analysis, a measurement model was obtained, responsible for evaluating the reliability, validity and fit of the model. Validity was confirmed through the reliability indicators of the items, which exceeded the standard of 0.70 (Fig. 2).

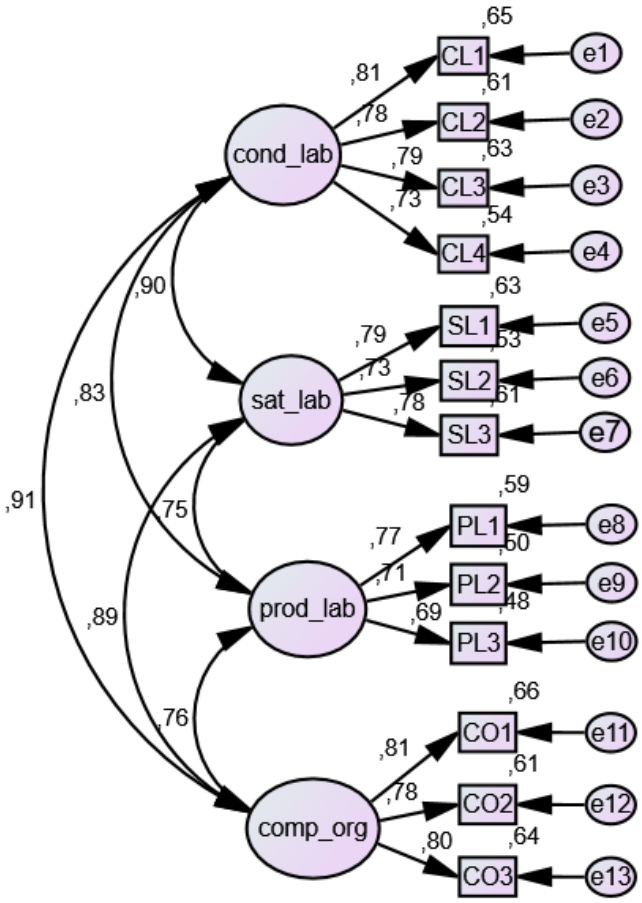


**Fig. 2.** Measurement model

## 4. Reliability, validity and fit of the measurement model

To evaluate construct quality, the Average Variance Extracted (AVE) was calculated, which measures the proportion of variance explained by the construct relative to measurement error. The AVE values ranged from 0.522 to 0.650, exceeding the recommended minimum threshold of 0.50 (Table 4).

The model fit indices indicated an excellent fit: CMIN/DF = 1.467, below the acceptable limit of 5; Tucker–Lewis Index (TLI) = 0.977; Comparative Fit Index (CFI) = 0.985; and Normed Fit Index (NFI) = 0.955—all above the recommended 0.90 threshold. Additionally, the Root Mean Square Error of Approximation (RMSEA) was 0.073, falling within the acceptable range (< 0.08), confirming that the model adequately represents the observed data.

**Table 4.** Measurement model, factor loadings, reliability and average variance extracted

| Factor | Item | Factor loadings | Cronbach's alpha | Composite reliability | Average variance extracted (AVE) |
|---|---|---|---|---|---|
| **Job Satisfaction** | SL1 | 0,776 | 0,809 | 0,796 | 0,568 |
| | SL2 | 0,713 | | | |
| | SL3 | 0,771 | | | |
| **Organizational Commitment** | CO1 | 0,823 | 0,839 | 0,852 | 0,657 |
| | CO2 | 0,797 | | | |
| | CO3 | 0,812 | | | |
| **Working Conditions** | CL1 | 0,809 | 0,861 | 0,856 | 0,599 |
| | CL2 | 0,78 | | | |
| | CL3 | 0,785 | | | |
| | CL4 | 0,719 | | | |
| **Labor Productivity** | PL1 | 0,749 | 0,766 | 0,766 | 0,522 |
| | PL2 | 0,677 | | | |
| | PL3 | 0,739 | | | |

## DISCUSSION

The findings of this study confirm that job performance in the shrimp farming industry is shaped by a complex network of psychosocial variables, among which job satisfaction, organizational commitment, working conditions, and productivity stand out as the most prominent. This multidimensional relationship aligns with previous research highlighting how these factors act as key predictors of individual performance, particularly in demanding and vulnerable aquaculture environments **(Panjaitan, 2021)**. The validated factorial structure coincides with that proposed by **Singh and Khatri (2023)**, who argued that perceptions of the work environment directly influence worker behavior and motivation. Similarly, **Imran *et al.* (2012)** emphasized that structured work environments with clear objectives and adequate support improve job performance.

These results reinforce the need to evaluate labor performance not only from a technical or economic standpoint but also from a psychosocial and environmental perspective. In coastal shrimp aquaculture systems, where physical effort is intensive and tasks are performed under hot, humid, and potentially hazardous conditions, occupational health, job satisfaction, and emotional well-being become central to achieving sustainable productivity. Moreover, these working conditions are shaped by broader environmental factors such as water quality, salinity, effluent management, and climate variability—all of which have direct implications for sustainability and long-term resilience in aquaculture operations.

Organizational commitment and working conditions also emerged as critical determinants of labor performance. **Mohammed and Eleswed (2013)** argued that organizational commitment strengthens the bond between workers and companies, reducing staff turnover and improving productivity. Adequate, safe, and equitable work environments enhance employee engagement, particularly in aquaculture settings where workers face prolonged sun exposure, slippery surfaces, and limited infrastructure in remote areas **(Day & Bedeian, 1991)**. These findings suggest that, beyond immediate operational outcomes, labor performance is closely tied to the quality of life of workers and the environmental integrity of their workplaces.

Labor productivity, as confirmed in this study, reflects not only operational efficiency but also the alignment between individual competencies and organizational goals. When job performance is high, resource use becomes more efficient, decision-making improves, and production quality increases. In shrimp farming—an activity heavily dependent on natural resources such as brackish water, land, and energy—enhancing labor productivity contributes not only to economic outputs but also to the responsible and sustainable use of those resources, especially when linked to effective time management and worker autonomy **(Hunt, 2000)**.

The model proposed in this study represents a methodological innovation by integrating a mixed approach that combines exploratory and confirmatory factor analysis with qualitative inquiry. In contrast to previous studies that relied exclusively on quantitative tools or participatory techniques without statistical validation **(Aggarwal, 2013; Panjaitan, 2021)**, this model offers a more robust and comprehensive framework by incorporating both objective indicators and the subjective experiences of workers. It provides an opportunity to align labor performance evaluation with broader sustainability goals, particularly in aquaculture systems located in ecologically sensitive coastal areas.

This analytical framework, grounded in statistical rigor and field-based evidence, offers replicability across other aquaculture and agro-industrial sectors that share similar environmental and organizational vulnerabilities **(Valenzuela-Cobos *et al.*, 2020; Valenzuela-Cobos *et al.*, 2023)**. It contributes not only to enhancing internal human resources strategies but also to advancing the understanding of how psychosocial well-being intersects with environmental sustainability in the Global South. As shrimp farming and other aquaculture sectors face increasing pressure from climate change, disease outbreaks, and resource degradation, models such as the one validated in this study can help inform more equitable, efficient, and environmentally responsible labor policies.

## Limitations and future research

One of the main limitations of this study lies in its geographic scope, as the research focused exclusively on the province of Guayas, which may limit the generalizability of the

findings to other shrimp-farming regions in Ecuador. Additionally, the sample consisted of 250 workers, which, while sufficient for robust statistical analysis, may not fully represent the national shrimp aquaculture sector.

Another limitation is the cross-sectional design, which did not allow for an analysis of how the evaluated factors evolve over time. Furthermore, the use of self-administered surveys introduces potential social desirability bias, as some participants may have provided responses they perceived as more acceptable rather than reflecting their actual experiences.

Future research should aim to expand the sample to include shrimp farms from other coastal provinces—such as El Oro, Manabí, and Esmeraldas—to enhance the external validity of the findings. Longitudinal studies are recommended to monitor the evolution of labor performance indicators over time and assess the long-term impact of labor welfare initiatives on productivity and retention.

Additional variables—such as leadership style, organizational culture, and occupational stress—could be integrated to develop a more comprehensive understanding of the determinants of labor performance in aquaculture environments. Applying the proposed model in other agro-industrial or aquaculture-related sectors—such as tilapia farming or fish processing plants—would also allow for testing its factorial structure and adaptability in diverse organizational contexts.

Finally, incorporating complementary qualitative methods, such as in-depth interviews or focus groups, is recommended to enrich the understanding of workers' lived experiences, perceptions of working conditions, and overall well-being in coastal aquaculture operations.

## CONCLUSION

The validated model confirms that labor performance in the shrimp farming industry is shaped by a set of interrelated psychosocial factors—job satisfaction, working conditions, labor productivity, and organizational commitment. These dimensions influence not only individual outcomes but also the collective capacity of aquaculture systems to remain competitive, efficient, and sustainable in the face of increasing global demands and environmental pressures.

In tropical aquaculture environments such as Ecuador's coastal shrimp sector—where natural resource use is intensive and working conditions are often physically demanding—understanding and improving psychosocial well-being is essential for ensuring long-term resilience. This study contributes an integrated model that supports both academic inquiry and organizational decision-making, providing shrimp farming

enterprises with a robust framework for identifying performance gaps and implementing targeted human capital strategies.

By incorporating both quantitative indicators and workers' subjective perceptions, the model aligns labor management with human-centered and environmentally responsible practices. It underscores the importance of promoting decent work as a fundamental pillar of sustainability in coastal production systems, particularly in regions affected by hydrological stress, salinity fluctuations, ecosystem degradation, and socio-economic vulnerability.

The application and replication of this model in other aquaculture or agro-industrial sectors could inform the development of policies that integrate labor well-being with the responsible and efficient use of natural resources. In doing so, it contributes to broader efforts to promote sustainable rural development and ecological stewardship in tropical coastal regions.

**Data availability statement**

The authors will make the raw data supporting the conclusions of this article available without undue restrictions.

**Author Contributions**

Conceptualization, S.J.T.-M. and M.V.P.-S.; formal analysis, C.V.-Y.; investigation, S.J.T.-M.; methodology, S.J.T.-M. and M.V.P.-S.; supervision, C.V.-Y.; writing—original draft, S.J.T.-M., M.V.P.-S. and C.V.-Y.; writing—review and editing, S.J.T.-M. All authors have read and agreed to the published version of the manuscript.

**Conflict of interest**

The authors declare no conflicts of interest

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