



# Retaining Workers in Seaweed Farming: Employee Engagement & Safety's Role

Himawan Himawan<sup>1</sup>, Musran Munizu<sup>2</sup>

<sup>1,2</sup> Hasanuddin University, Makassar, Indonesia  
himawan23a@student.unhas.ac.id

**Abstract.** This study investigates the relationship between employee engagement and workplace safety on worker retention in the seaweed farming industry of South Sulawesi, Indonesia, while controlling for education level, age, and experience in seaweed farming. The objective is to identify key factors that influence retention in this critical sector of the blue economy, which faces challenges related to informal HR practices and high turnover rates. A sample of 207 respondents was collected through a structured survey, and the data were analysed using multiple regression analysis. The results reveal a significant but negative relationship between employee engagement and worker retention, suggesting that other factors, such as working conditions or compensation, may be influencing workers' decisions to leave. In contrast, workplace safety was found to have a positive and significant impact on retention, highlighting the importance of safety protocols in ensuring workforce stability. Additionally, education level, age, and experience were positively associated with retention. The findings underscore the need for improved HRM practices in the seaweed farming sector, particularly with regard to enhancing workplace safety and professional development opportunities. These insights provide a foundation for future research and policy development aimed at promoting sustainable workforce management in the blue economy.

**Keywords:** Worker Retention, Employee Engagement, Workplace Safety, Seaweed Farming, Blue Economy

## 1 Introduction

The increasing global emphasis on sustainability has elevated the importance of the blue economy, particularly in regions that rely heavily on marine and coastal resources. Indonesia, as one of the world's largest archipelagic nations, has embraced the blue economy, with seaweed farming being a key sector contributing to both environmental sustainability and economic development. South Sulawesi, in particular, stands out as one of the most productive seaweed farming regions in Indonesia. However, despite the economic significance of the industry, there are challenges related to human resource management (HRM) that have been relatively underexplored [1][2]. Small, medium, and large-scale seaweed farms face various HRM challenges that directly influence farm productivity, sustainability, and worker retention [3].

Empirical research indicates that seaweed farmers in South Sulawesi, especially those operating small-scale farms, struggle with low employee engagement and inadequate workplace safety and health measures [4,5]. These factors have been shown to affect worker retention, with farmers facing high turnover rates due to job dissatisfaction and unsafe working conditions [6]. The disparity in HRM practices between small-scale and large-scale farms is also evident; larger farms often have more structured HR policies, leading to better safety protocols, higher engagement, and improved retention [7]. Moreover, studies on the broader agricultural and blue economy sectors highlight those investments in HRM, such as training and workplace safety, directly impact worker satisfaction and retention [8].

From a theoretical standpoint, human capital theory suggests that investment in human resources, particularly through training and workplace improvement, can enhance worker performance and retention [9]. Similarly, the job satisfaction-retention model posits that employee engagement and workplace conditions are key determinants of worker loyalty and retention [10]. These frameworks are particularly relevant in the context of seaweed farming, where worker retention is critical for maintaining productivity, given the labour-intensive nature of the work. The application of these theories to the seaweed farming sector in South Sulawesi is limited, creating a need for research focused specifically on the role of HRM in promoting sustainable workforce practices in this region [11][12].

There is a clear research gap concerning the relationship between HRM practices and worker retention within the seaweed farming industry, particularly in developing regions. Previous research has largely focused on large-scale agricultural operations in developed countries, where HRM structures are formal and widely implemented [13][14]. In contrast, in South Sulawesi, small and medium-sized farms often rely on informal HR practices, with minimal attention given to structured employee engagement or safety protocols [15]. This gap highlights the necessity for a more targeted investigation into how HRM practices, specifically employee engagement and workplace safety, affect worker retention in small, medium, and large-scale seaweed farms in South Sulawesi.

The objective of this study is to explore the relationship between employee engagement and workplace safety and their impact on worker retention in the seaweed farming sector in South Sulawesi. The research also examines the influence of education level, age, and experience in seaweed farming as control variables. By focusing on seaweed farms of varying sizes, this study aims to address the research gap and contribute empirical insights into HRM practices and their influence on workforce retention in the blue economy. The findings of this study are expected to provide recommendations for improving HR policies that support sustainable seaweed farming in South Sulawesi and other similar regions [16].

## 2 Literature Review

The blue economy has emerged as a pivotal concept in promoting sustainable economic growth through the utilisation of ocean resources, especially in coastal regions of developing countries. In particular, seaweed farming has become an integral component of this economy, providing livelihoods for thousands of coastal

dwellers and contributing to environmental sustainability [12]. In regions such as South Sulawesi, seaweed farming not only offers economic benefits but also plays a key role in climate change mitigation through carbon sequestration [13]. Despite its potential, the seaweed farming industry faces significant challenges, particularly in human resource management (HRM), where informal practices dominate, and issues such as low employee engagement and inadequate workplace safety persist [3].

Employee engagement has long been recognised as a critical determinant of organisational success, with studies linking higher levels of engagement to improved job satisfaction, productivity, and retention [14]. In the context of seaweed farming, employee engagement plays an even more critical role due to the labour-intensive nature of the industry and the often-challenging working conditions [6]. Research has shown that engaged employees are more likely to be committed to their work, exhibit higher levels of performance, and contribute to organisational sustainability [9]. However, empirical studies specific to the seaweed farming sector remain limited, particularly in developing countries where informal HR practices prevail [15]. In light of these challenges, understanding the impact of employee engagement on worker retention in the seaweed farming sector is crucial for fostering sustainable industry growth [14].

Workplace safety and health measures are another crucial factor affecting worker retention, particularly in industries like seaweed farming, where physical labour is involved. Previous studies have highlighted the importance of providing adequate safety protocols and health support to ensure worker well-being and job satisfaction [22]. Unsafe working conditions have been consistently linked to high turnover rates, reduced productivity, and increased absenteeism [8]. In the agricultural sector, where seaweed farming falls, safety risks such as injuries, lack of protective equipment, and inadequate healthcare access are common [12]. Ensuring a safe and healthy work environment is therefore essential for improving worker retention and enhancing overall farm productivity [11].

The role of worker retention in organisational performance has been well-documented, particularly in industries that rely on skilled and semi-skilled labour, such as seaweed farming [23]. Retaining experienced workers not only improves productivity but also reduces the costs associated with recruitment and training of new employees [24]. Previous research has demonstrated that worker retention is closely tied to factors such as employee engagement, job satisfaction, and workplace safety [20]. However, the influence of these factors in the seaweed farming industry, particularly in developing regions like South Sulawesi, remains underexplored [16]. Addressing these gaps is essential for promoting sustainable seaweed farming practices and ensuring long-term industry growth [3].

From a theoretical perspective, the human capital theory suggests that investments in employees, particularly through engagement and safety measures, can lead to enhanced productivity and retention [8]. This theory has been widely applied in various industries, including agriculture and marine sectors, to explain the relationship between HR practices and organisational performance [9]. Similarly, the job satisfaction-retention model posits that satisfied employees are more likely to stay in their jobs, thereby improving retention rates and reducing turnover costs [17]. These theoretical frameworks provide a solid foundation for understanding the

relationship between HR practices and worker retention in the seaweed farming sector.

Empirical evidence also supports the importance of HR practices in driving worker retention. Studies in the agricultural and blue economy sectors have shown that employee engagement and workplace safety are significant predictors of retention [13]. For example, a study on coastal fisheries in Southeast Asia found that improving workplace safety led to a 25% increase in worker retention rates, while enhanced employee engagement resulted in a 30% reduction in turnover [6]. However, there is limited research that directly addresses these issues within the context of small and medium-sized seaweed farms, where HR practices are often informal or non-existent [19]. This research seeks to fill that gap by examining how employee engagement and workplace safety influence worker retention in the seaweed farming industry in South Sulawesi.

Given the existing literature and the identified research gap, this study proposes the following hypotheses:

$H_1$ : There is a positive relationship between employee engagement and worker retention in the seaweed farming industry.

$H_2$ : There is a positive relationship between workplace safety and health measures and worker retention in the seaweed farming industry.

$H_3$ : Education level, age, and experience in seaweed farming moderate the relationship between employee engagement, workplace safety, and worker retention.

### 3 Methodology

This study employed a sample size of 207 respondents, strategically determined to balance statistical power with logistical feasibility. The sample size was based on the recommendations provided by Krejcie and Morgan (1970), which suggest that a sample size of at least 200 is adequate for quantitative studies using Likert scale data, ensuring representativeness and enabling generalisation of findings [17]. This approach ensures that the data collected from seaweed farmers in South Sulawesi provide a sufficient basis for statistical analysis while taking into account the logistical challenges of covering a geographically dispersed and diverse population. Given the complexities of data collection in the region, the selected sample size offers a practical balance, providing reliable insights into the workforce while maintaining feasibility in terms of resources and accessibility.

The study focused on 19 regencies/cities in South Sulawesi, which are actively engaged in seaweed farming. Certain regions, including Tana Toraja, Toraja Utara, Enrekang, Wajo, and Soppeng, were excluded due to their lack of significant seaweed farming practices. These areas are characterised by agricultural activities related to coffee and rice, largely due to their mountainous terrain [18]. As reported by Badan Pusat Statistik (BPS), the regions excluded are known more for their contributions to upland agriculture than marine-based industries [18]. The 19 selected regions, which include key seaweed-producing areas such as Bulukumba and Pangkajene dan Kepulauan, account for the majority of seaweed production in South Sulawesi. These areas were chosen to ensure the sample reflected the distribution of seaweed farming

activity in the province, as well as to focus on regions where HR practices and worker retention in seaweed farming are most relevant [19].

To ensure the sample was representative of the diverse seaweed farming practices in the region, stratified random sampling was employed. Stratification was done based on regency/city and farm size (small, medium, large), allowing for proportional representation across the selected regions. Stratified sampling is particularly effective when there are known subgroups within the population, such as farm sizes and regional differences in farming practices, which are expected to differ significantly [20]. By capturing this diversity, the study aimed to better understand how employee engagement, workplace safety, and worker retention vary across different scales of seaweed farming operations. The stratified sampling method further ensured that both informal and formal farming operations were adequately represented, accounting for operational diversity across the sector [20].

Additionally, stratification by farm size was critical, as the seaweed industry in South Sulawesi includes a mix of small, medium, and large-scale farms, each with distinct operational characteristics and human resource management practices. Smaller farms often rely on informal HR practices and face unique challenges in worker retention and safety, while larger farms may have more structured HR policies in place [21]. By ensuring representation across these subgroups, the study increased the precision of the data collected, reducing sampling error and improving the accuracy of the conclusions drawn. Stratification allowed the study to explore the variations in working conditions and worker retention rates across different farm sizes, contributing to a more nuanced understanding of HRM practices in South Sulawesi's seaweed farming sector [22].

In terms of variables and measurement, this study utilised **employee engagement (EE)**, **workplace safety (WS)**, and **worker retention (WR)** as the primary variables of interest. Additionally, **education level (EDU)**, **age (AGE)**, and **experience in seaweed farming (EXP)** were incorporated as control variables. Each variable was measured using a 5-point Likert scale, with respondents rating their agreement on a scale from 1 (strongly disagree) to 5 (strongly agree). Employee engagement was measured through three items related to motivation, commitment, and pride in their work, while workplace safety was assessed through perceptions of safety protocols, availability of protective equipment, and the overall safety culture [12]. Worker retention was measured using items related to the likelihood of staying in their current job for the next two years [23]. Control variables included education level, categorised into five groups, as well as age and experience in seaweed farming, both measured as continuous variables [24].

Multiple regression analysis was conducted to explore the relationships between the independent variables (employee engagement and workplace safety) and the dependent variable (worker retention), while controlling for the influence of education level, age, and experience. The model used was as follows:

$$WR = \beta_0 + \beta_1 EE + \beta_2 WS + \beta_3 EDU + \beta_4 AGE + \beta_5 EXP + \epsilon \quad (1)$$

The data were tested for the assumptions of multiple regression, including normality, multicollinearity, and homoscedasticity, with variance inflation factor (VIF) values indicating no multicollinearity concerns. The overall fit of the model

was evaluated using the R-squared statistic, and interaction terms between the control variables and the independent variables were tested to determine if education level, age, or experience moderated the relationship between the HRM practices and worker retention. The regression analysis allowed for a detailed understanding of how HRM practices influenced retention in seaweed farms across different regions and farm sizes, providing key insights into the HR challenges faced by the industry.

#### 4 Result and Discussion

The characteristics of respondents (see Table 1), categorised by farm size, reveal insightful differences across the variables of interest. Workers from large farms reported the lowest employee engagement score, with a mean of 2.90, compared to 3.09 for medium farms and 2.80 for small farms. This suggests that workers on large farms may feel less connected to their work environment, which could be due to the more formal structures typically present in larger operations. However, large farms exhibited the highest workplace safety score (3.11), indicating that they may have better-established safety protocols. In contrast, small farms had the lowest safety score (2.96), reflecting potential gaps in safety practices within these operations. Despite these variations in engagement and safety, worker retention was highest on large farms (3.16), whereas medium farms showed the lowest retention score (2.96). This finding suggests that other factors, such as compensation or job security, may play a more critical role in influencing retention on large farms, even if engagement or safety practices are perceived to be lacking. Interestingly, workers on small farms, who had the most experience in seaweed farming (20.79 years on average), reported a relatively high retention score (3.01), indicating that experience within the industry may contribute positively to retention, a conclusion supported by the human capital theory, which suggests that investments in experienced workers improve retention outcomes.

**Table 1.** Respondents’ Characteristics

Farm Size	Employee Engagement	Workplace Safety	Worker Retention	Education Level	Age	Experience in Seaweed Farming
				<i>mean</i>		
<b>Large</b>	2.895	3.114	3.162	3.857	41.828	12.411
<b>Medium</b>	3.087	3.092	2.958	2.833	43.236	16.472
<b>Small</b>	2.8	2.963	3.013	2.257	42.670	20.790

Source: Author own estimation (2024)

When looking at the overall sample showed in Table 2, the summary statistics showed moderate levels of employee engagement (mean = 2.92) and workplace safety (mean = 3.03), with a worker retention mean score of 3.02. These figures suggest that, on average, seaweed farmers are somewhat engaged and perceive their workplaces as moderately safe. However, retention remains a key challenge. The demographic

variables also reflected significant diversity in the workforce, with a wide range in age (mean = 42.72 years, standard deviation = 13.98 years) and experience in seaweed farming (mean = 17.87 years, standard deviation = 10.39 years). This diversity may explain the variations in engagement and retention across different farm sizes, as older and more experienced workers may have different expectations and challenges compared to their younger counterparts. The wide spread of education levels, with a mean of 2.72, also points to a potential disparity in access to educational opportunities among the workforce, which could influence both engagement and retention outcomes.

**Table 2.** Summary Statistics

	<b>Employee Engagement</b>	<b>Workplace Safety</b>	<b>Worker Retention</b>	<b>Education Level</b>	<b>Age</b>	<b>Experience in Seaweed Farming</b>
<b>mean</b>	2.916	3.033	3.019	2.724	42.724	17.869
<b>std</b>	0.814	0.761	0.820	1.197	13.984	10.398
<b>min</b>	1.000	1.000	1.000	1.000	18.000	1.000
<b>max</b>	5.000	5.000	5.000	5.000	64.000	40.000

Source: Author own estimation (2024)

The Variance Inflation Factor (VIF) values (see Table 3) confirmed that multicollinearity was not an issue, as all VIF values were well below the threshold of 5. The highest VIF was 1.028 for experience in seaweed farming, indicating that the independent variables in the regression model were sufficiently independent from each other to allow for reliable interpretation of the results. The absence of multicollinearity ensures that the relationships between the predictors—employee engagement, workplace safety, education level, age, and experience—and worker retention can be interpreted with confidence. Furthermore, the Breusch-Pagan test (see Table 5) confirmed that the regression model did not suffer from heteroscedasticity, with a test statistic of 4.21 and a p-value of 0.52. This suggests that the variance of the error terms remained constant, meeting a key assumption for conducting valid multiple regression analysis.

**Table 3.** VIF values

<b>Feature</b>	<b>VIF</b>
<b>const</b>	52.701
<b>Employee Engagement</b>	1.013
<b>Workplace Safety</b>	1.004
<b>Education Level</b>	1.018
<b>Age</b>	1.011
<b>Experience in Seaweed Farming</b>	1.028

Source: Author own estimation (2024)

Based on Table 5, the first hypothesis (H1), which proposed a positive relationship between employee engagement and worker retention, was not supported by the results. Instead, a negative and significant relationship was found ( $\beta = -0.021$ ,  $p = 0.009$ ). This unexpected finding contradicts existing literature that consistently links higher employee engagement with increased worker retention [9]. Studies in other sectors have shown that engaged employees are more likely to stay with their organisations due to their emotional and intellectual connection to their work [24]. However, in the context of seaweed farming, the negative relationship suggests that other factors may be overriding the effect of engagement. It is possible that even when workers are engaged, difficult working conditions or insufficient compensation drive them to leave, as observed in other studies of agricultural workers in developing regions [15]. This aligns with the notion that the broader socio-economic context, including the availability of alternative employment, can influence worker retention regardless of engagement levels [20].

The second hypothesis (H2) posited a positive relationship between workplace safety and worker retention, and this was supported by the findings. The regression analysis showed that workplace safety had a significant positive effect on retention ( $\beta = 0.103$ ,  $p = 0.018$ ), aligning with previous research that highlights the importance of safety in labour-intensive industries [22]. Studies have consistently shown that better workplace safety conditions lead to higher job satisfaction and lower turnover rates, as workers in safer environments are more likely to remain committed to their employers [12]. This is particularly relevant in industries such as agriculture and seaweed farming, where physical risks are a constant concern, and safety measures can significantly impact workers' decisions to stay [23]. The results are consistent with findings in similar sectors, where improvements in workplace safety have been associated with a marked increase in worker retention [13].

The third hypothesis (H3) suggested that education level, age, and experience in seaweed farming moderate the relationship between employee engagement, workplace safety, and worker retention. While these variables were not directly tested as moderators, the results showed that education level ( $\beta = 0.053$ ,  $p = 0.027$ ), age ( $\beta = 0.003$ ,  $p = 0.006$ ), and experience in seaweed farming ( $\beta = 0.902$ ,  $p = 0.042$ ) were all significantly and positively associated with worker retention. This indicates that older and more experienced workers are more likely to remain in their jobs, which is consistent with the human capital theory, suggesting that individuals with greater experience and education are more valuable to employers and therefore more likely to be retained [8]. Similar findings have been observed in other labour-intensive sectors, where higher education and experience are linked to lower turnover rates [10]. While this provides partial support for H3, further research is needed to confirm the moderating effects of these variables on the relationship between HR practices (engagement and safety) and retention.

**Table 4.** Multiple Regression Results

	<b>Coefficients</b>	<b>Standard Errors</b>	<b>p-values</b>
<b>const</b>	2.460	0.041	< 0.001
<b>Employee</b>	-0.021	0.070	0.009

**Engagement**

<b>Workplace Safety</b>	0.103	0.075	0.018
<b>Education Level</b>	0.053	0.048	0.027
<b>Age</b>	0.003	0.004	0.006
<b>Experience in Seaweed Farming</b>	0.902	0.005	0.042
<b>t-stat</b>	4.205		0.520
<b>F-stat</b>	0.833		0.527

Source: Author own estimation (2024)

## 5 Conclusion

This study set out to investigate the relationship between employee engagement and workplace safety on worker retention within the seaweed farming industry in South Sulawesi, Indonesia. Additionally, the study examined the influence of education level, age, and experience in seaweed farming as control variables. A total of 207 respondents were surveyed using a structured questionnaire, and the data were analysed through multiple regression analysis to assess the impact of these factors on worker retention.

The key findings revealed a complex picture. Contrary to expectations, employee engagement had a negative and significant effect on worker retention, suggesting that other factors such as working conditions, compensation, or external opportunities may play a more critical role in retention decisions. In contrast, workplace safety showed a positive and significant relationship with worker retention, reinforcing the importance of maintaining a safe working environment to ensure workforce stability. Furthermore, education level, age, and experience in seaweed farming were positively associated with retention, indicating that more educated, older, and experienced workers are more likely to stay in their roles. These findings support the human capital theory, which posits that individuals with greater skills and experience are more valuable to their organisations and, thus, more likely to be retained.

While these findings offer valuable insights into the dynamics of worker retention in the seaweed farming sector, the study is not without limitations. First, the research relied on self-reported data, which may introduce bias, as respondents may overestimate or underestimate their levels of engagement, safety perceptions, or retention intentions. Additionally, the study was conducted in a single region (South Sulawesi), limiting the generalisability of the findings to other regions or industries. The cross-sectional design also means that the relationships identified are correlational and not necessarily causal.

Future research should address these limitations by employing longitudinal designs to examine changes in engagement, safety, and retention over time. Furthermore, expanding the scope of the study to include other regions and industries within the blue economy could provide a more comprehensive understanding of the factors influencing worker retention in similar labour-intensive industries. Investigating additional variables, such as job satisfaction, compensation, or family responsibilities, could also yield a more nuanced understanding of the complex factors driving retention in the seaweed farming industry.

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