*Fisheries Journal,* 15 (1), 454-465 (2025)
http://doi.org/10.29303/jp.v15i1.1436

# OPTIMIZATION OF OCCUPATIONAL HEALTH AND SAFETY IMPLEMENTATION IN THE LEMURU FISH PROCESSING PROCESS IN THE MODERN INDUSTRY OF JEMBRANA BALI

## Optimalisasi Implementasi Kesehatan dan Keselamatan Kerja dalam Proses Pengolahan Ikan Lemuru di Industri Modern Jembrana Bali

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(Received February 4th 2025; Accepted February 28th 2025)

**ABSTRACT**

The fisheries industry, especially in the processing of lemuru fish, has various work risks that can affect the safety and health of workers. These risks include the use of sharp tools, exposure to chemicals, slippery work environments, and the potential for injury due to intensive production processes. Therefore, the implementation of Occupational Health and Safety (OHS) is a crucial aspect in ensuring a safe, efficient, and productive work environment. However, in practice, there are still various obstacles in the implementation of OHS, such as lack of worker awareness, limited safety facilities, and a less-than-optimal supervision system. This study aims to analyze the implementation of OHS in the processing of lemuru fish at XYZ Company, Jembrana, and to identify obstacles and optimize strategies. The research method used is descriptive qualitative with observation techniques, interviews, and SWOT analysis of OHS policies. The results of the study indicate that the implementation of K3 has been running well through the use of personal protective equipment (PPE), compliance with work procedures, and the implementation of safety standards. To be able to optimize this activity, it can be done through increased training, routine supervision, and the use of IoT-based technology for monitoring the work environment. Computer-based OHS management systems, Virtual Reality (VR) technology for simulation, and automation of high-risk processes with robotics can also be applied to reduce work accidents. Data analysis with machine learning also helps in risk prediction. These implementation strategies can improve work safety, create a safer and more comfortable work environment, and increase the competitiveness of the industry in the global market.

Keywords: Lemuru Fish Processing, Modern Industry, Occupational Health and Safety, Optimization, Technology

**ABSTRAK**

Industri perikanan, khususnya dalam pengolahan ikan lemuru, memiliki berbagai risiko kerja yang dapat mempengaruhi keselamatan dan kesehatan pekerja. Risiko tersebut meliputi penggunaan alat tajam, paparan bahan kimia, lingkungan kerja yang licin, serta potensi cedera akibat proses produksi yang intensif. Oleh karena itu, penerapan Kesehatan dan Keselamatan Kerja (K3) menjadi aspek krusial dalam memastikan lingkungan kerja yang aman, efisien, dan produktif. Namun dalam praktiknya, masih terdapat berbagai kendala dalam penerapan K3, seperti kurangnya kesadaran pekerja, keterbatasan terdapat fasilitas keselamatan, serta sistem pengawasan yang belum optimal. Penelitian ini bertujuan untuk menganalisis implementasi K3 dalam pengolahan ikan lemuru di Perusahaan XYZ, Jembrana, serta mengidentifikasi kendala dan optimalisasi strategi. Metode penelitian yang digunakan adalah deskriptif kualitatif dengan teknik observasi, wawancara, dan analisis SWOT terhadap kebijakan K3. Hasil penelitian menunjukkan bahwa penerapan K3 telah berjalan dengan baik melalui penggunaan alat pelindung diri (APD), kepatuhan terhadap prosedur kerja, serta penerapan standar keselamatan. Untuk dapat mengpoptimalkan kegiatan ini dapat dilakukan melalui peningkatan pelatihan, pengawasan rutin, dan pemanfaatan teknologi berbasis IoT untuk pemantauan lingkungan kerja. Sistem manajemen K3 berbasis komputer, teknologi Virtual Reality (VR) untuk simulasi, serta otomatisasi proses berisiko tinggi dengan robotik juga dapat diterapkan untuk mengurangi kecelakaan kerja. Analisis data dengan pembelajaran mesin juga membantu dalam prediksi risiko. Strategi penerapan ini dapat meningkatkan keselamatan kerja, menciptakan lingkungan kerja yang lebih aman dan nyaman, serta meningkatkan daya saing industri di pasar global.

Kata Kunci: Industri Modern, Kesehatan dan Keselamatan Kerja, Optimalisasi, Pengolahan Ikan Lemuru, Teknologi

## INTRODUCTION

Occupational Health and Safety (K3/OHS) is an important aspect in the fisheries industry, especially in the fish processing process (Saputra, 2021; Tafana & Sunardi, 2021; Tisna, 2024). OHS aims to prevent work accidents, occupational diseases, and increase labor productivity (Dj, 2020; Kendek et al., 2023; Nugraha et al., 2021). The fisheries industry, including the processing of lemuru fish (Sardinella longiceps), has various potential risks, such as the use of sharp tools, exposure to chemicals, and a humid and slippery work environment. Therefore, the implementation of OHS in this industry is very crucial to ensure worker safety and maintain the quality of the products produced (Sadipun & Sudirman, 2021).

Although K3 plays an important role in the fisheries industry, there are still various problems in its implementation (Nugraha et al., 2024; Perangin-angin et al., 2023; Yanto et al., 2023). Several companies still face obstacles such as lack of worker awareness of the importance of K3, minimal training and supervision, and limited adequate safety facilities (Maurier et al., 2011; Mawardi, 2021b; Wabula & Tunny, 2021). XYZ Company as one of the fisheries industries in Jembrana also has the potential to face challenges in implementing K3, especially in the processing of lemuru fish. These factors can increase the risk of work accidents and reduce production efficiency (Hamja et al., 2022; Pawening & Martiana, 2023). Therefore, more in-depth research is needed on the implementation of K3 in this company to determine the extent of its implementation and the challenges faced.

This research is important to do because worker safety is a fundamental aspect in the industrial world (Antoro, D. et al., 2018; K. Kuncowati, 2018; Kurniawan, A. et al., 2018). Good implementation of K3 can improve worker welfare, reduce the number of work accidents, and improve quality and productivity in the production process (Mawardi, 2021a). In addition, the results of this study are expected to provide insight for companies in improving K3

implementation policies and strategies. Academically, this study can also be a reference for further studies related to K3 in the fisheries industry.

Several previous studies have discussed the importance of implementing K3 in various industrial sectors, including the fisheries industry (Nugraha et al., 2024). For example, research conducted by Nugraha in 2024 showed that good implementation of K3 can reduce work accidents and increase production efficiency. However, specific studies that discuss the implementation of K3 in the lemuru fish processing process at XYZ Company as one of the modern fish processing industries in Jembrana are still limited. Therefore, this study has a novel value in providing a more specific picture of how the implementation of K3 is carried out, the challenges faced, and efforts to improve it.

The main objective of this study is to analyze the implementation of K3 in the lemuru fish processing process at XYZ Company, Jembrana. This study also aims to identify the obstacles faced and provide recommendations for improving the implementation of K3 in the company (Noroozi & Taherian, 2023b, 2023a; Olcay et al., 2021). The scope of this study is limited to the aspects of occupational health and safety in the lemuru fish processing unit, without discussing other aspects such as overall human resource management.

Based on the background that has been explained, this study will answer several main questions such as the implementation of K3 in the lemuru fish processing process at XYZ Company, Jembrana, the obstacles faced in implementing K3 in the company and efforts that can be made to improve the implementation of K3 in order to improve safety and work efficiency. By answering these questions, this study is expected to make a significant contribution to efforts to improve the implementation of K3 in the fisheries industry.

## METHODS

Research on the Implementation of Occupational Health and Safety (K3) in the Processing Process of Lemuru Fish at XYZ Company in Jembrana, the research method used can include several approaches. This approach is used to provide an overview and further analysis to optimize the implementation of occupational health and safety in the processing process of lemuru fish in modern industries in Jembrana Bali.

### Time and Place

This research was conducted at XYZ Company, Jembrana, Bali, which is one of the largest lemuru fish processing industries in the region. The selection of XYZ Company, Jembrana as the location of research on Optimizing the Implementation of Occupational Health and Safety (K3) in the Processing Process of Lemuru Fish in Modern Industries in Jembrana, Bali is based on several main reasons. XYZ Company is one of the largest and leading lemuru fish processing industries in Jembrana, Bali. This company has an important role in the fisheries sector, especially in the processing of lemuru fish which is a leading commodity in the area. The company has also implemented an Occupational Health and Safety (OHS) system according to modern industry standards, including the use of occupational safety equipment, standard operating procedures, and efforts to maintain product cleanliness and hygiene. This makes it a relevant location to study the effectiveness of OHS implementation and opportunities for its optimization. From a research perspective, Company XYZ provides an interesting case study related to the challenges and opportunities in implementing OHS in the fisheries industry. By analyzing the implementation of OHS in this company, the study can identify factors that support success and obstacles that need to be fixed. In addition, this company has a significant contribution to the local economy and fishery product exports, so that optimizing OHS not only has an impact on worker safety, but also on product quality and industry competitiveness in the global market. The study was conducted for three months

(October-December 2025) and within a time frame adjusted to the company's production schedule to ensure that the data obtained is relevant and accurate.

**Tools and Materials**

This study uses two types of data sources, namely primary and secondary data. Primary data is obtained directly from field observations, interviews with workers, supervisors, and managers responsible for implementing OHS. Secondary data were obtained from company documents, OHS reports, government regulations related to OHS, and relevant previous research. Observation activities were carried out by directly observing the implementation of OHS in the work environment, including the use of Personal Protective Equipment (PPE), workplace conditions, and worker compliance with safety standards. Interviews were conducted in a semi-structured manner with workers, OHS officers, and company management to obtain in-depth information regarding the implementation of OHS and the obstacles faced. Documentation activities were carried out by collecting related documents such as company policies, work accident reports, and OHS guidelines implemented at Company XYZ. To support this activity, in general, the tools and materials used in this study include:

1. Observation Tools: Digital camera for documentation, notebooks, and stationery.
2. Interview Tools: voice recorder and semi-structured interview question list.
3. Supporting Documents: Work accident reports, company policies related to OHS, and government regulations regarding work safety.

**Research Procedure**

This study uses a qualitative descriptive method, which aims to provide an in-depth overview of the implementation of K3 in the lemuru fish processing process and how to optimize it. This method is used to understand how K3 policies are implemented, the obstacles faced, and the efforts made to improve occupational safety in the company. The research procedure is carried out in the following stages:

1. Field Observation: Direct observation of the implementation of K3 in the work area, including the use of personal protective equipment (PPE), compliance with safety procedures, and work environment conditions.
2. Semi-Structured Interviews: Conducted with workers, K3 officers, supervisors, and managers to gain perspective on the effectiveness of K3 implementation and the obstacles faced.
3. Documentation and Literature Study: Collecting and analyzing company reports, K3 policies, and relevant scientific references.
4. SWOT Analysis: Evaluating the strengths, weaknesses, opportunities, and threats in the implementation of K3 in the company.

**Parameters Measured**

The parameters described in this study include:

1. Compliance with K3: Use of PPE, compliance with safety procedures, and the presence of K3 officers.
2. Work Environment Conditions: Equipment safety, workplace ergonomics, and air quality monitoring through IoT-based technology.
3. OHS Training and Awareness: Frequency of occupational safety training and effectiveness of OHS education programs.

**Data Analysis**

The data obtained were analyzed using a qualitative descriptive analysis method with data reduction, data presentation, and conclusion drawing steps. Data reduction is done by

sorting and filtering data that is relevant to the focus of the study. Data presentation is done by compiling data in the form of descriptions, tables, or diagrams to facilitate understanding. Conclusions are drawn by analyzing the results of observations, interviews, and documentation to obtain conclusions regarding the effectiveness of OHS implementation and recommendations for improvement. To ensure data accuracy, this study uses a source triangulation method, namely comparing data from observations, interviews, and documentation to obtain more valid and objective results. With this method, the study is expected to provide a comprehensive picture of the implementation of OHS in the lemuru fish processing process at XYZ Company and provide recommendations that can improve occupational safety and health in the company.

## RESULTS

The implementation of Occupational Safety and Health (K3) in a company is very important to create a safe, healthy, and productive work environment for all employees. At Company XYZ, employees have used K3 equipment properly, such as hats, masks, and shoes while working. This aims to minimize the risk of work accidents in the production area and prevent contamination. Details of the K3 equipment used can be seen in Table 1.

The implementation of Occupational Safety and Health (K3) in the lemuru fish processing process at Company XYZ has been running well. This is evidenced by the K3 equipment used by employees and the fulfillment of the work processes that have been provided.

Employees at Company XYZ use various K3 equipment in the lemuru fish processing process. The equipment includes hats, hijabs, masks, protective dacron, gloves, boots, and socks. This equipment is used to protect employees from the risk of work accidents and to maintain the cleanliness and safety of the products produced. In addition, employees implement K3 by following the work instructions that have been provided in each room. These instructions cover all stages of the lemuru fish processing process, from receiving raw materials to storing them in the finished product warehouse. Compliance with these instructions ensures that the entire process runs safely, efficiently, and according to established standards.

The results and discussion are written separately. The research results are presented carefully in the form of tables, curves, graphs, photos, or other forms, as needed, completely and clearly, such as: units, conditions, experiments, and others. It is necessary to ensure that when reading the research results in this format, the reader does not need to look for related information from the description in the discussion.

Table 1. Application of K3 in the Processing of Lemuru Fish in Modern Industry in Jembrana Bali

| Room | Equipment | Documentation |
|---|---|---|
| Raw material receiving room | 1. Hats (men) 20 pieces<br>2. Hijab (women) 7 pieces<br>3. Gloves 27 pieces<br>4. Boots 27 pieces<br>5. Socks 27 pieces |  |

| Room | Equipment | Documentation |
|---|---|---|
| | |  |
| Production room (cutting, washing, filling, precooking, draining, sauce filling, can closing, and washing) | 1. Hats (men) 10 pieces<br>2. Hijab (women) 338 pieces<br>3. Masks 348 pieces<br>4. Boots 348 pieces<br>5. Socks 348 pieces<br>6. Dacron 348 pieces |  <br>  <br>  |
| Can soaking room | 1. Hats (men) 6 pieces<br>2. Masks 6 pieces<br>3. Gloves 6 pieces<br>4. Boots 6 pieces<br>5. Socks 6 pieces |  <br>  |
| Retort sterilization room | 1. Hats (men) 8 pieces<br>2. Masks 8 pieces<br>3. Boots 8 pieces<br>4. Socks 8 pieces |  |

| Room | Equipment | Documentation |
|---|---|---|
| Canning room | 1. Hats (men) 5 pieces<br>2. Hijab (women) 5 pieces<br>3. Masks 10 pieces<br>4. Gloves 10 pieces |  |
| Incubation room | 1. Hats (men) 10 pieces<br>2. Hijab (women) 5 pieces<br>3. Gloves 15 pieces<br>4. Masks 15 pieces |  |
| Finished product warehouse | 1. Hats (men) 10 pieces<br>2. Hijab (women) 10 pieces<br>3. Gloves 20 pieces<br>4. Masks 20 pieces |  |

## DISCUSSION

The fish processing industry in Bali has implemented more modern Occupational Health and Safety (OHS) standards to ensure worker safety and maintain the quality of the products produced. The implementation of OHS in this industry includes several important aspects, such as the use of advanced technology, risk management systems, and strict regulations to create a safer and more efficient work environment.

A number of companies have adopted automatic and semi-automatic machines, such as cutting machines, blast freezers, and conveyor systems that help speed up the production process while maintaining worker safety. In addition, the management system implements risks to identify, analyze, and reduce potential hazards in the workplace. These steps include waste management, contamination prevention, and ergonomic arrangements to prevent repetitive activity injuries.

To improve worker protection, companies in Bali require the use of appropriate safety equipment, such as cut-resistant gloves, non-slip shoes, air filtration masks, and hearing protection for workers in high-distraction environments. In addition, regular occupational safety training is provided to employees to raise their awareness of the importance of OHS. Training materials include the use of personal protective equipment (PPE), emergency evacuation procedures, and how to handle chemicals used in the production process.

Some companies have even adopted international standards such as ISO 45001 (Occupational Health and Safety Management System) and HACCP (Hazard Analysis and Critical Control Points) to ensure that the products produced are safe for consumption and processed with high safety standards. The implementation of this technology and stricter regulations not only improves work safety but also contributes to production efficiency and the competitiveness of the fish processing industry in the global market.

Although specific literature on optimizing the implementation of K3 in lemuru fish processing in Jembrana is still limited, several studies and reports show that the implementation of appropriate technology, strict quality control, and attention to working conditions play an important role in improving the safety and health of workers in the fisheries industry (Haslindah et al., 2023; Lating & Dolang, 2023; Nugraha et al., 2024). With these steps, the fish processing industry in Bali can increase productivity, ensure worker safety, and ensure that

the products produced meet international standards, which ultimately strengthens competitiveness in the global market.

**SWOT Analysis of Occupational Health and Safety Implementation in Fish Processing Process**

SWOT analysis plays an important role in the implementation of Occupational Health and Safety (OHS) in fish processing activities. In terms of strengths, this analysis helps identify safety procedures that are already running well, such as the use of personal protective equipment (PPE) and compliance with hygiene standards. Weaknesses found, such as inadequate training for workers or inadequate facilities, can be used as a basis for improvement. In addition, opportunities such as the application of modern technology and government-supported training programs can be utilized to improve occupational safety. However, this analysis also identifies threats, such as the risk of accidents due to sharp tools, slippery work environments, or exposure to chemicals from the preservation process. By conducting a SWOT analysis, companies can design more effective strategies in implementing OHS, reducing the risk of accidents, and increasing worker productivity in the fish processing industry. The SWOT analysis of the implementation of OHS in Lemuru fish processing activities at modern companies in Jembrana Bali is as follows.

Strengths:
• Availability of sufficient OHS equipment for employees.
• Clear and structured work instructions in each room.
• Employee compliance with the implemented K3 procedures.
• A work environment that supports safety and cleanliness aspects.

Weaknesses:
• Lack of socialization or regular training on the importance of K3.
• Limitations in the implementation of K3 in all work areas.
• Possible shortage of stock or routine maintenance of K3 equipment.

Opportunities:
• Implementation of technology to improve supervision and compliance with K3.
• Increasing employee awareness through K3 training programs and campaigns.
• Collaboration with related agencies to improve the quality of K3 implementation.

Threats:
• Potential work accidents due to employee negligence or non-compliance.
• Changes in regulations that can affect the company's K3 policies.
• External environmental factors that can affect working conditions, such as extreme weather or natural disasters.

**How to Optimize the Implementation of K3**

To optimize the implementation of K3 in Company XYZ, the company can take several strategic steps. One of the main steps is to increase employee training and awareness of the importance of K3 through regular training programs and the provision of educational materials such as posters, videos, or simulations. In addition, supervision and evaluation must be tightened by assigning K3 officers to conduct routine inspections and provide sanctions or awards for employees who comply with K3 procedures. The provision and maintenance of K3 equipment must also be considered by ensuring the availability of personal protective equipment in good condition and providing backups if needed. Companies can also utilize technology in the implementation of K3, such as a digital system to monitor its existence and an incident reporting application that makes it easier for employees to report violations or work accidents. In addition, creating a work culture that is aware of K3 can be done with safety campaigns, slogans, and awards for employees who contribute to improving the

implementation of K3. With these steps, the implementation of K3 can be more optimal, thus creating a safe, comfortable, and productive work environment.

Optimizing the implementation of Occupational Health and Safety (K3) in the processing of lemuru fish in modern industries can be done effectively by utilizing computer engineering systems. One approach that can be applied is an IoT-based environmental monitoring system. IoT sensors can be used to maintain temperature, humidity, and air quality in the processing area to prevent hazardous working conditions. In addition, sensors can also be installed to detect ammonia gas or other chemicals used in the fish preservation process. Real-time monitoring of machine performance with an IoT system is also important to provide early warning if there is potential damage that risks endangering workers. Furthermore, a computer-based K3 management system can help identify, freeze, and control K3 risks in processing facilities. This system includes risk management applications, automatic incident reporting that allows workers to report incidents in real time, and an K3 dashboard that provides a visual display of data, such as accident statistics, audit results, and compliance levels.

Another approach that can be implemented is virtual training and simulation. Virtual Reality (VR) technology can be used to accommodate emergency situations such as fires or chemical spills, so that workers are ready to face the situation. In addition, computer-based K3 e-learning can provide interactive learning modules that can be accessed at any time. In terms of processing, automation of high-risk processes such as fish cutting, packaging, or moving heavy loads through robotics and automated process control systems is very effective in reducing human involvement, so that the risk of work accidents can be minimized. Data analytics for risk prediction also plays an important role, where machine learning (ML) algorithms can be used to analyze K3 data and predict areas with high potential for accidents. Big data analysis also helps in identifying patterns and trends from historical data to optimize K3 policies.

Finally, the implementation of an early warning and rapid response system will improve worker safety. Wearable devices such as smart watches can be used to connect workers' vital signs and provide warnings if workers are in dangerous conditions. In addition, an automatic emergency response system that can activate safety protocols such as alarms and automatic evacuation if potential sensors detect danger will be very useful. By integrating these various technologies, the implementation of K3 in the lemuru fish processing process in the modern industry in Jembrana, Bali can be significantly optimized, creating a safer and more efficient work environment.

In this section, researchers systematically compile with rational arguments about scientific information obtained in the research. Especially information that is relevant to the research problem. Discussion of the research results obtained can be presented in the form of theoretical descriptions, both qualitatively and quantitatively. In its implementation, this section can be used to compare the research results obtained in the research being conducted with the research results reported by previous researchers. Scientifically, the research results obtained in the research can be in the form of new findings or improvements, confirmations, or rejections of the interpretation of a scientific phenomenon from previous researchers.

## CONCLUSION

The implementation of Occupational Health and Safety (OHS) in the processing of lemuru fish in the modern industry in Jembrana, Bali, has been running well and in accordance with applicable standards. The implementation of OHS is carried out through the use of safety equipment such as hats, hijabs, masks, gloves, boots, socks, and protective dacron, which function to protect workers and maintain product hygiene. In addition, employees have also followed the work instructions set at each stage of production, from receiving raw materials to storing finished products. Based on the SWOT analysis, the main strength of the

implementation of OHS is the availability of adequate equipment and employees' fulfillment of safe work procedures. However, there are still weaknesses such as the need for increased supervision and regular training. Opportunities to improve the implementation of OHS can be done through the use of modern technology and international standard certification, while the main threats are the potential for worker negligence and changes in regulations that must always be monitored. To optimize the implementation of OHS, companies need to increase worker awareness and understanding through regular training, tighten supervision, and implement a digital system to monitor compliance. With these steps, the lemuru fish processing industry in Jembrana can improve efficiency, work safety, and the quality of the products produced, so that it can compete in the global market.

## ACKNOWLEDGEMENT

Thanks to the Ministry of Maritime Affairs and Fisheries and the Indonesian Institute of Business and Technology for all the support provided.

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