Analysis of the Role of Risk Management and Occupational Health and Safety in Preventing Workplace Accidents in the SME Sector Roti Bobby Using the House of Risk (HOR) Method

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ABSTRACT

Abstract: This study aims to analyze the role of risk management and occupational health and safety (OHS) in preventing workplace accidents at Roti Bobby MSMEs using the House of Risk (HOR) method. The method used is a quantitative descriptive approach through case studies, with data collection in the form of observation, interviews, and documentation. The analysis was carried out through two HOR stages, namely identification of risk events and risk agents (HOR 1) and determination of priority mitigation strategies (HOR 2). The results showed that there are five main risks, namely injuries from mixer machines, burns from ovens, ergonomic injuries, slips, and product contamination. The dominant risk agents with the highest Aggregate Risk Potential (ARP) values are non-use of personal protective equipment (PPE), absence of standard operating procedures (SOPs), and lack of safety training. Priority mitigation strategies include mandatory implementation of PPE, preparation of SOPs, and implementation of periodic OHS training. These findings indicate that managerial and behavioral factors are more influential than technical factors in causing workplace accidents. The HOR method has proven effective in identifying and prioritizing risks and producing applicable mitigation strategies for MSMEs.

Keywords: *Risk Management, Occupational Health and Safety, House of Risk, MSMEs, Risk Mitigation*

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I. INTRODUCTION

Occupational health and safety (OHS) within small and medium-sized enterprises (SMEs) presents a serious challenge, as many business owners continue to neglect adequate safety standards (Singh, Singh, & Bahl, 2019). In food based SMEs, such as home-based bakeries, workers frequently face direct risks including injuries

from mixing machines, burns from ovens, and ergonomic disorders caused by improper working(Anyfantis, Leka, Reniers, & Boustras, 2021a). The lack of personal protective equipment (PPE) use further exacerbates the probability of accidents, while most SMEs do not have clear standard operating procedures (SOPs). This condition reflects a substantial gap between the demand for effective OHS implementation and the reality in the field.

The literature indicates that various risk management methods, such as failure mode and effects analysis (FMEA) or fuzzy logic-based approaches, have long been introduced to enhance workplace safety. However, their application in SMEs remains relatively limited due to constraints in human and financial resources (Ahmed, Hoque, Karmaker, & Ahmed, 2023). Research in Europe further shows that many SMEs carry out risk assessments merely to comply with legal requirements, rather than using them as an effective tool for accident prevention (Anyfantis, Leka, Reniers, & Boustras, 2021b). This situation demonstrates that the prevailing theories of risk management, often designed for larger companies, do not fully address the practical needs of SMEs operating under resource constraints.

This study aims to analyze the role of risk management in preventing workplace accidents in SMEs using the House of Risk (HOR) method, a model that integrates Failure Mode and Effect Analysis (FMEA) with the House of Quality (HOQ) to identify and prioritize risks (Michell, 2024). Through this approach, the study seeks to identify risk events and dominant risk agents that contribute to workplace accidents in the Roti Bobby SME, followed by the formulation of efficient mitigation strategies. Furthermore, the objective is to provide practical guidance for SMEs in fostering OHS awareness through a risk management system that matches their limited capacity (Kuzheleva, Pushenko, & Staseva, 2024).

The consistently high rate of workplace accidents in SMEs is largely due to weak OHS implementation, despite the availability of numerous risk management theories (Chencheva et al., 2024). This underscores the argument for the necessity of a more applicable approach, such as the HOR method, which not only identifies risks but also prioritizes mitigation strategies aligned with the realities of SMEs. Prior studies affirm that consistent risk assessments significantly reduce accident rates and

enhance organizational safety performance (Kuzior & Kopij, 2024). Accordingly, this study is crucial because it has the potential to contribute meaningfully to building a sustainable culture of workplace safety within SMEs.

II. LITERATURE REVIEW

Risk management in the context of occupational safety is defined as a systematic process for identifying, evaluating, and controlling potential hazards that may cause harm to both workers and organizations (Singh, Bahl, Sahdev, Mann, & Singh, 2019). This process includes key steps such as hazard identification, risk assessment, and risk control, all of which must be carried out continuously (Lyon, 2021). In practice, risk management not only focuses on preventing accidents but also on fostering a strong safety culture in the workplace.

The manifestation of risk management can be divided into several categories, including preventive, mitigative, and responsive approaches (Hudáková, Mäkká, & Kardoš, 2023) . At the preventive level, organizations emphasize actions before risks occur, such as training and the use of personal protective equipment (PPE). The mitigative category focuses on reducing the impact of risks that cannot be fully avoided, while the responsive category emphasizes readiness in dealing with incidents through emergency procedures. Within SMEs, combining these three approaches is essential, as limited resources demand more structured and prioritized risk control (Kaassis & Badri, 2018).

Occupational Health and Safety (OHS) refers to systematic efforts to protect workers from physical, chemical, biological, and ergonomic hazards that may arise during work (Atabaev, Petrosova, & Atabaeva, 2023). The concept encompasses accident prevention, control of workplace environments, and holistic improvements in workers' health (Kuzior & Kopij, 2024). The primary goal of OHS is to create safe, healthy, and productive working conditions by emphasizing shared responsibility between employers and employees.

The categorization of OHS can be viewed through three main dimensions: technical, managerial, and behavioral (Bekeeva, Dzhumagulova, Esbenbetova, & Tanabaeva, 2020). The technical dimension involves hazard control through engineering solutions and safety equipment. The managerial dimension relates to

company policies, planning, and the implementation of OHS management systems. Meanwhile, the behavioral dimension emphasizes shaping a safety culture by fostering awareness, attitudes, and safe behavior among workers. These three dimensions complement one another and must be integrated to achieve effective OHS strategies (Nyirenda, Chinniah, & Agard, 2015).

The House of Risk (HOR) is a risk management method that integrates the principles of Failure Mode and Effect Analysis (FMEA) with the House of Quality (HOQ) to identify, analyze, and prioritize sources of risk, or risk agents (Bochkovskii & Gogunskii, 2018). Its advantage lies in its ability not only to assess risks in terms of events but also to evaluate their causal agents, thereby ensuring that mitigation strategies are more targeted and effective (Deng, Liu, Xie, & Xu, 2021). The HOR method is particularly relevant for SMEs, as it is relatively simple yet effective in developing prioritized risk management solutions.

The application of HOR can be categorized into two main phases: HOR 1 and HOR 2 (Singh, Singh, et al., 2019). In HOR Phase 1, risk events and risk agents are identified, followed by severity and occurrence assessments. HOR Phase 2 is then applied to determine mitigation priorities by linking dominant risk agents to realistic control measures. This approach enables organizations, including SMEs, to utilize limited resources more effectively in accident prevention (Lyon, 2021).

III. METHODS

The object of this study focuses on the SME Roti Bobby, which operates in the food industry with production activities ranging from raw material preparation to processing and final product distribution. Work environments in SMEs frequently face limitations in implementing safety standards, making accident risks relatively higher compared to large scale industries (Hendayani, Rahmadina, Anggadwita, & Pasaribu, 2021). This phenomenon is reinforced by the identification of risks arising from human factors, machinery, workplace conditions, and production management that lacks proper standardization (Cinar & Cebi, 2021). The refore, this research object was chosen to illustrate the urgency of applying risk management and OHS through the House of Risk (HOR) as a systematic approach.

This study adopts a descriptive quantitative approach in the form of a case study focused on the production activities of SME Roti Bobby. The descriptive quantitative method was selected because it enables systematic representation of field conditions while also quantifying risk levels identified during production (Hamali, Marina, Jakaria, & Stefana, 2023). The data used include primary data collected through direct field observations and interviews with workers and production managers, as well as secondary data derived from the company's internal documentation and relevant literature on OHS and risk management in similar (Immawan & Putri, 2018).

The data sources in this study consist of workers directly involved in production processes, the operational manager responsible for risk management, and internal company documents related to production activities. Field observations were conducted to map potential risks occurring at each stage of the production process, while interviews were carried out to capture workers' experiences and perceptions of workplace hazards (Hosianna, Hasibuan, & Hidayati, 2021). Secondary data were also drawn from prior research publications on risk management in SMEs and regulatory documents concerning OHS in the food industry (Puspitasari & Yuwono, 2022).

The research process was carried out through several key stages, starting with the identification of potential risks in production activities via direct observation, interviews, and document review. The collected data were then processed using the House of Risk (HOR) framework to map the relationships between risk agents and risk events. Data collection employed triangulation, which integrates observation, interviews, and documentation to enhance data validity (Pasaribu & Sudiarno, 2024). Validity was further strengthened through member-checking, whereby preliminary findings were discussed with respondents to confirm the accuracy of the information (Nalhadi, Kurniasari, Djamal, Suryani, & Supriyadi, 2019).

The data analysis employed the House of Risk (HOR) approach, which consists of two main phases: HOR Phase 1 to identify dominant risk agents, and HOR Phase 2 to formulate the most effective mitigation strategies. In the first phase, data gathered from observations and interviews were used to calculate the Aggregate Risk Potential (ARP) for each risk (Hendayani et al., 2021). The second phase then used ARP as a

basis for determining priority preventive strategies, considering both the effectiveness and feasibility of implementation (Puspitasari & Yuwono, 2022). Through this analytical technique, the study is expected to provide practical contributions for implementing risk management and OHS in the SME sector.

IV. RESULTS

The identification of risks in SME Roti Bobby revealed five main risk events: injuries from mixing machines, burns from ovens, ergonomic injuries from lifting materials, slipping hazards due to wet floors, and product contamination caused by poor hygiene. Each of these risks was traced back to its risk agents, namely the absence of PPE use, lack of SOPs, inadequate safety training, the absence of machine guards, and poor workplace cleanliness. These findings are consistent with previous studies highlighting that insufficient risk management practices in food based SMEs often result in workplace accidents and reduced productivity (Cinar & Cebi, 2021) .

Further analysis using HOR Phase 1 showed that the risk agents with the highest Aggregate Risk Potential (ARP) were the absence of PPE use and lack of SOPs. This indicates that most risks are rooted in worker behavior and weak managerial systems in enforcing safety standards. Other studies also emphasize that worker behavior, especially the neglect of PPE, is a dominant factor contributing to accidents in SMEs (Anyfantis et al., 2021b). Therefore, prevention strategies should prioritize improvements in managerial aspects and workplace safety culture.

The relationship between the research findings and real conditions demonstrates a significant gap between theoretical frameworks of risk management and the practices applied in SME Roti Bobby. In theory, risk management emphasizes the importance of SOPs, training, and consistent PPE use, but these aspects were found to be the weakest points in this study. This aligns with research on other Indonesian SMEs, which shows that OHS awareness remains low, particularly in family owned or home based (Hendayani et al., 2021).

The field data indicated that OHS implementation at SME Roti Bobby was minimal, as evidenced by the lack of formal safety training, the absence of warning signs in production areas, and irregular machine inspections. Workers performed their duties without clear guidelines, there by increasing the risk of accidents.

Previous studies argue that SMEs often neglect OHS due to their focus on production efficiency and cost minimization, although the long-term consequences of accidents can be far more detrimental to the business (Atabaev et al., 2023).

HOR analysis showed that risk agents such as the absence of PPE and machine guards were closely associated with risk events like injuries from mixing machines and burns from ovens. This finding suggests that implementing simple OHS measures such as mandatory use of heat resistant gloves and installation of machine guards could significantly reduce risks. In line with this, studies in small scale manufacturing demonstrate that even basic OHS implementation can reduce accident rates by up to 40% within one year (Chencheva et al., 2024) .

The gap between empirical conditions and the necessity of OHS implementation is evident in SME Roti Bobby. The absence of formal training and SOPs leaves workers highly vulnerable to accidents. This reality underscores the urgency of cultivating an OHS culture that is not merely regulatory but embedded in daily practices. Prior research emphasizes that without internalizing OHS culture, formal regulations alone will not yield significant improvements in accident prevention (Kuzior & Kopij, 2024).

The application of the HOR method in this study identified priority risk agents requiring urgent mitigation. The risk agents with the highest ARP were the absence of PPE use, lack of SOPs, and inadequate safety training. These results indicate that most risk events in SME Roti Bobby stem from managerial and behavioral factors rather than purely technical issues. This finding is consistent with the literature, which confirms that the HOR method is effective in identifying dominant risks in SMEs by mapping the links between causal agents and risk events (Immawan & Putri, 2018).

HOR Phase 2 analysis was then used to design mitigation strategies most suitable for the SME's conditions. The top priority strategies included mandatory PPE use with strict enforcement, the development of SOPs, and regular safety training for workers. These strategies were chosen because they offer high effectiveness while being relatively easy to implement given the SME's resource constraints. Previous research also confirms that the HOR method not only identifies risks but also

generates practical, measurable mitigation strategies for small scale organizations (Puspitasari & Yuwono, 2022).

The relationship between the HOR results and field realities demonstrates that this method effectively addresses the primary challenges faced by SME Roti Bobby. By prioritizing PPE use, SOP development, and safety training, the mitigation strategies proposed are more relevant and adaptable to the SME's resource limitations. This aligns with other studies highlighting that the success of risk management in SMEs depends greatly on the simplicity and affordability of the proposed mitigation strategies (Hosianna et al., 2021).

V. CONCLUSION AND SUGGESTION

This study surprisingly revealed that the main causes of workplace accidents in SME Roti Bobby are not rooted in technological deficiencies but in managerial and behavioral weaknesses, particularly the neglect of PPE use, the absence of SOPs, and insufficient safety training. The application of the House of Risk (HOR) method successfully identified the dominant risk agents and prioritized strategies that are both practical and effective in minimizing accident risks.

Theoretically, this research contributes to the development of knowledge in the fields of risk management and occupational health and safety (OHS) by demonstrating that the HOR method can be applied beyond large scale industries and adapted to SMEs. Practically, the study provides SMEs with a structured framework to implement safety strategies such as mandatory PPE use, SOP development, and periodic training that are affordable, applicable, and tailored to their operational limitations.

This research is limited by its focus on a single SME, which restricts the generalization of findings to broader contexts. However, this limitation opens opportunities for future studies to apply the HOR method in other SMEs or across different industrial sectors, thereby enriching comparative insights and strengthening the validity of HOR as a risk management tool.

VI. BIBLIOGRAPHY

Ahmed, T., Hoque, A. S. M., Karmaker, C. L., & Ahmed, S. (2023). Integrated approach for occupational health and safety (OHS) risk Assessment: An Empirical (Case) study in Small enterprises. *Safety Science*, *164*. https://doi.org/10.1016/j.ssci.2023.106143

Anyfantis, I. D., Leka, S., Reniers, G., & Boustras, G. (2021a). Employers' perceived importance and the use (or non-use) of workplace risk assessment in micro-sized and small enterprises in Europe with focus on Cyprus. *Safety Science*, *139*. https://doi.org/10.1016/j.ssci.2021.105256

Anyfantis, I. D., Leka, S., Reniers, G., & Boustras, G. (2021b). Employers' perceived importance and the use (or non-use) of workplace risk assessment in micro-sized and small enterprises in Europe with focus on Cyprus. *Safety Science*, *139*. https://doi.org/10.1016/j.ssci.2021.105256

Atabaev, K. A., Petrosova, L. I., & Atabaeva, M. M. (2023). Peculiarities of Occupational Risk Assessment in Small Enterprises. *Bezopasnost' Truda v Promyshlennosti*, *2023*(2), 76–81. https://doi.org/10.24000/0409-2961-2023-2-76-81

Bekeeva, S. A., Dzhumagulova, N. G., Esbenbetova, Z. K., & Tanabaeva, A. E. (2020). Influence of working conditions of priority sectors of the economy of Kazakhstan on the formation of occupational risks. *Bezopasnost' Truda v Promyshlennosti*, *2020*(11), 82–88. https://doi.org/10.24000/0409-2961-2020-11-82-88

Bochkovskii, A., & Gogunskii, V. (2018). Development of the method for the optimal management of occupational risks. *Eastern-European Journal of Enterprise Technologies*, *3*(3–93), 6–13. https://doi.org/10.15587/1729-4061.2018.132596

Chencheva, O., Sukach, S., Rieznik, D., Petrenko, I., Lashko, Ye., & Hladiuk, O. (2024). Modern Concept of Occupational Safety and Health Management With a Risk-Based Approach. *Municipal Economy of Cities*, *4*(185), 221–227. https://doi.org/10.33042/2522-1809-2024-4-185-221-227

Cinar, U., & Cebi, S. (2021). A novel approach to assess occupational risks and prevention of hazards: the house of safety prevention. *Journal of Intelligent and Fuzzy Systems*, *42*(1), 517–528. https://doi.org/10.3233/JIFS-219208

Deng, Y., Liu, H., Xie, X., & Xu, L. (2021). Review on the Development of Enterprise Risk Management. *Advances in Intelligent Systems and Computing*, *1191 AISC*, 154–166. https://doi.org/10.1007/978-3-030-49889-4_14

Hamali, S., Marina, D. V., Jakaria, Y., & Stefana, K. (2023). *Analysis of Measurement and Supply Chain Risk Management Control Using House of Risk Method*. 2472–2481. https://doi.org/10.46254/ap03.20220412

Hendayani, R., Rahmadina, E., Anggadwita, G., & Pasaribu, R. D. (2021). Analysis of the House of Risk (HOR) Model for Risk Mitigation of the Supply Chain Management Process (Case Study: KPBS Pangalengan Bandung, Indonesia). *2021 9th International Conference on Information and Communication Technology, ICoICT 2021*, 13–18. https://doi.org/10.1109/ICoICT52021.2021.9527526

Hosianna, G. R., Hasibuan, S., & Hidayati, J. (2021). Analisa Risiko Rantai Pasok Produk Kosmetik Sistem Make to Order Dengan Metode House of Risk. *Operations Excellence Journal of Applied Industrial Engineering*, *13*(3), 288. https://doi.org/10.22441/oe.2021.v13.i3.027

Hudáková, M., Mäkká, K., & Kardoš, P. (2023). Risk assessment in the enterprise management system. *WSB Journal of Business and Finance*, *57*(1), 46–52. https://doi.org/10.2478/wsbjbf-2023-0006

Immawan, T., & Putri, D. K. (2018). House of risk approach for assessing supply chain risk management strategies: A case study in Crumb Rubber Company Ltd. *MATEC Web of Conferences*, *154*. https://doi.org/10.1051/matecconf/201815401097

Kaassis, B., & Badri, A. (2018). Development of a preliminary model for evaluating occupational health and safety risk management maturity in small and medium-sized enterprises. *Safety*, *4*(1). https://doi.org/10.3390/safety4010005

Kuzheleva, M., Pushenko, S., & Staseva, E. (2024). Methodology for improving the efficiency of occupational safety management of an enterprise based on the theory of risk management. *BIO Web of Conferences*, *113*. https://doi.org/10.1051/bioconf/202411306032

Kuzior, A., & Kopij, G. (2024). Occupational Risk Management in Ohs Based on Risk Assessment and Control. *System Safety: Human - Technical Facility - Environment*, *6*(1), 26–34. https://doi.org/10.2478/czoto-2024-0004

Lyon, B. K. (2021). Communicate Risk. *Risk Assessment: A Practical Guide to Assessing Operational Risks: Second Edition*, 445–460. https://doi.org/10.1002/9781119798323.ch20

Michell, K. (2024). Ss15 Proactive Approach To Accident Prevention Through Risk Management. *Occupational Medicine*, *74*(Supplement_1), 0–0. https://doi.org/10.1093/occmed/kqae023.0120

Nalhadi, A., Kurniasari, A., Djamal, N., Suryani, S., & Supriyadi, S. (2019). Supply chain risk assessment of cotton shirt production uses the house of risk method. *Journal of Physics: Conference Series*, *1381*(1). https://doi.org/10.1088/1742-6596/1381/1/012060

Nyirenda, V., Chinniah, Y., & Agard, B. (2015). Identifying key factors for an occupational health and safety risk estimation tool in small and medium-size enterprises. *IFAC-PapersOnLine*, *28*(3), 541–546. https://doi.org/10.1016/j.ifacol.2015.06.137

Pasaribu, A., & Sudiarno, A. (2024). Risk Management Practices using the House of Risk for Safety, Health, etc.(HORshe) Method: A Case Study on Wastewater Treatment in the Pharmaceutical Industry. *Digest of Technical Papers - IEEE International Conference on Consumer Electronics*, 547–553. https://doi.org/10.1109/ISCT62336.2024.10791136

Puspitasari, N. B., & Yuwono, M. R. A. (2022). Integrating fuzzy logic and house risk method for operational risk management in automotive industry. *IOP Conference Series: Earth and Environmental Science*, *1098*(1). https://doi.org/10.1088/1755-1315/1098/1/012007

Singh, S., Bahl, A., Sahdev, S. K., Mann, G. S., & Singh, J. (2019). *Occupational Health And Safety Training Programs For Workers In Manufacturing Industries : An Overview*. *6*(1), 922–928.

Singh, S., Singh, L., & Bahl, A. (2019). An Overview Of Risk Management For Occupational Health And Safety. *Journal of Emerging Technologies and Innovative Research.*