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MBKM Kesmas Report by Design FKM Unair at PT. Garuda *Maintenance Facility* Aeroasia TBK

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ABSTRACT
The MBKM Kesmas by Design program bridges theoretical knowledge and practical OSH implementation at PT GMF AeroAsia Tbk., an aviation maintenance facility with high-risk operations. Objectives: This study aims to (1) identify hazards in *scrap* area grinding/manual handling, (2) assess risks via HIRADC analysis, and (3) propose targeted controls. Field observations, worker interviews, and risk evaluations were conducted, aligned with the hierarchy of control (elimination to PPE). The study identified 15 grinding hazards (e.g., sparks, vibration) and 6 manual handling risks (e.g., overload injuries), with high-risk activities (e.g., severed hands, back injuries) requiring engineering/administrative interventions. Post-control, residual risks were reduced to low/moderate levels. The program demonstrates how academic-industry collaboration can enhance OSH practices, urging adoption of digital hazard monitoring and standardized documentation. Findings are scalable to high-risk industries globally.

Introduction

The Faculty of Public Health (FKM) Universitas Airlangga (Unair) is one of the leading educational institutions in Indonesia that is committed to producing quality graduates in the field of public health. One of the programs implemented by FKM Unair to improve the competence of its graduates is the internship program. In general, the purpose of the internship program is to gain experience, skills, adjustment of attitudes and appreciation of knowledge in the world of work in order to enrich knowledge, attitudes, and skills, as well as to train the ability to work with others in a team so that mutual benefits are obtained for both the intern and the agency where the internship is held (Febriani, 2019; Masruroh & Muniroh, 2021; Wijayanti et al., 2021).

PT Garuda Maintenance Facility Aero Asia Tbk is a company engaged in aircraft maintenance, repair, and inspection. As part of Garuda Indonesia, PT Garuda Maintenance Facility Aero Asia integrates advanced technology and world-class management practices in its operations. Therefore, PT Garuda Maintenance Facility Aero Asia is a company with high work risks because it carries out various processes of managing goods and services that involve many parties, both with high-tech equipment and workers. PT Garuda Maintenance Facility Aero Asia has a major impact on the economy and the environment. PT Garuda Maintenance Facility Aero Asia is committed to maintaining high occupational health and safety standards.

Therefore, as a Public Health student who concentrates in the field of Occupational Health and Safety (K3), it takes the opportunity to learn and deepen knowledge directly from the best

practitioners related to the field of Occupational Health and Safety (K3) in the aviation industry at PT Garuda Maintenance Facility Aero Asia. Considering the prevalence of work accidents in several other industries, which of course is our main focus, especially in managing and handling various risks in the work environment and applying academic knowledge to the real workplace (Enn & Merisalu, 2019; Flores Rodríguez et al., 2016; Mishra & Palkhade, 2020; Wenas et al., 2021). Not only that, PT Garuda Maintenance Facility Aero Asia also allows us as students to better understand the work dynamics in the complex aircraft maintenance, repair, and inspection industry sector that involves interaction with various disciplines such as engineering, health, environment, and management.

These are some of the things that make our goal to choose PT Garuda Maintenance Facility Aero Asia as the place to carry out the internship. With this internship activity, it is hoped that it can increase knowledge about the world of work in the real industry, as well as learn useful knowledge that we have gained in college. We as students will certainly continue to learn to increase our knowledge, insights, in the hope of making the best contribution, dedication and synergy that is useful, especially for PT Garuda *Maintenance Facility* AeroAsia Tbk., the personality of students and the academic community. So there is a high possibility of a sustainable relationship between students, the academic community, and companies.

The purpose of the internship activity is to gain practical experience in skills, attitude adjustment, and applying knowledge in the workplace, particularly in public health sciences, while fostering teamwork abilities for mutual benefit to both the student interns and PT Garuda Maintenance Facility AeroAsia Tbk. Specifically, the internship aims to provide an overview of the company, familiarize interns with work procedures and the Occupational Safety and Health Management System (SMK3), and analyze workplace accident risks, as well as to assess the learning outcomes of various relevant courses, including Risk Management, Ergonomics and Work Skills II, K3 Implementation, Industrial Hygiene II, Industrial Toxicology II, Research Methodology, Occupational Diseases, and AKLPB.

The current research introduces a novel application of the MBKM Kesmas by Design program at PT GMF AeroAsia Tbk., specifically focusing on grinding and manual handling hazards in the *scrap* area, which has not been extensively documented in prior studies. Unlike earlier works that broadly address occupational safety (Hanom et al., 2020), this study provides a detailed HIRADC-based risk assessment and hierarchy of control implementation for high-risk aviation maintenance tasks, filling gaps in industry-specific OSH practices. Additionally, it integrates academic coursework (e.g., Ergonomics, K3, Toxicology) with real-world fieldwork, a approach not thoroughly explored in existing literature (Regulation of the Minister of Manpower No. 5/2018) (Herdianzah et al., 2023; Katabaro & Yan, 2019). The research also proposes scalable risk mitigation strategies, such as enhanced PPE protocols and administrative controls, advancing beyond generic recommendations in prior studies (Ho & Tenkate, 2024).

Materials and Methods

The implementation of MBKM by Design at PT. Garuda *Maintenance Facility* AeroAsia Tbk., starting with *Safety Induction*, then actively participate, especially in the TUK unit in the implementation of work activities such as *Safety Patrol*, inspection, P3K distribution, internal audit, *Toolbox Meeting*, routine 5Rs in TUK and colossal 5R, to investigation in case of accidents. Innovation participation is also carried out in the evaluation of procedures for the mitigation of safety and health risks of workers. As for reflection and *Feedback* MBKM by Design activities were carried out in the form of presentations of work results to the HSE team of PT. Garuda *Maintenance Facility* AeroAsia Tbk., and supervisor of MBKM by Design.

The data collection technique was carried out by direct observation in the area *Scrap* to know the process of work with grinding and *Manual handling*, worker compliance with the use of PPE, and implementation of risk control based on HIRADC. As for interviews with workers in the area *Scrap* PT. Garuda *Maintenance Facility* AeroAsia Tbk., in order to obtain in-depth data related to understanding, experience, and obstacles in the implementation of HIRADC *Corporate Affairs and* HSE (TU).

Results and Discussion

The research was carried out in the *Scrap,* which is the auspices of the Corporate Affairs & HSE Office, especially the TUG unit, PT. Garuda *Maintenance Facility* AeroAsia Tbk. The research was carried out by observing the work area and work process, as well as interviewing workers in the area *Scrap*.

Figure 1. Area Scrap

Job Description

1. Grinding

Based on the results of observations and interviews that have been conducted, the results of the grinding process carried out in the *scrap area* of PT. Garuda *Maintenance Facility* AeroAsia Tbk., as follows:

Table 1. Grinding Activity, November

Yes	Activity
1.	Preparation of grinding tools
2.	Grinding
3.	Cleaning of grinding waste (5R)

In the process of preparing the activity, workers prepare the tools to be used in the form of hand grinders, roll cables, and PPE (Personal Protective Equipment) needed, including *safety helmets, safety goggles,* masks, *earmuff/earplugs, wearpacks,* gloves, and *safety shoes*. The grinding stage is carried out by cutting aircraft components made of iron, aluminum, steel, titanium, as well as other materials such as rubber, polymer, and magnesium. Next, namely the cleaning stage and the 5R, workers ensure that the condition of the *scrap* area is neat and tools such as hand grinders, cables, PPE that have been used are returned to their original place.

2. Manual Handling *Activities*

Based on the results of observations and interviews that have been conducted, an overview of the process of implementing activities *Manual handling* which also coincide in the *Scrap* PT. Garuda *Maintenance Facility* AeroAsia Tbk., which is not much different from the stages of the grinding process.

Table 2. Manual Handling Activities, November 2024

Yes	Activity
1.	Preparation of transport equipment
2.	Implementation of manual handling
3.	(5R)

In the process of preparing manual handling, workers will prepare transportation equipment such as forklifts and hand pallets to move goods with heavy loads, beyond the maximum load capacity by human labor. For the implementation of manual handling with human power, PPE such as helmets, gloves, and *safety shoes is needed*, as well as support, namely *back support* to minimize back injuries when lifting weights.

Hazard Identification

a. Grinding

After the implementation of observations and interviews in the *Scrap*, the hazard identification was carried out. The grinding process is often carried out in a standing position and without the use of complete PPE, so workers have the potential to be exposed *low back pain* to accidents (Kannan & Arunachalam, 2019; Liu et al., 2021; Lv et al., 2020; Wei et al., 2023). Based on HIRADC Dinas *General Affairs* & HSE, grinding activities are not yet available. Therefore, the implementation of HIRADC *General Affairs* & HSE for grinding activities, with the following hazard identification:

Table 3. Identification of Grinding Hazards

Activity	Danger
Grinding Tool Preparation	Cables - cables that are stretched out irregularly in the work area
	Uneven surface of the work area
	Aircraft components lying on the floor of the

Activity	Danger
	work area
Grinding	Rotating grinding eyes
	The grinding eye rotates and detaches from the grinder
	Grams of grinding process
	Sparks from grinders
	Grinded aircraft components
	Terminal cable peeled off
	Body position
	Vibration
	Noisy
	Residues due to grinding
	hot objects due to grinding
Cleaning of grinding waste	Leftover grinding chips

There are 15 potential hazards in 3 grinding processes, including 11 mechanical hazards, 1 fire hazard, 1 electrical hazard, and 2 other hazards, namely physical and ergonomic hazards.

b. Manual Handling Activities

Based on the results of observations and interviews, the implementation of manual handling in the scrap area was carried out with human labor and forklift assistance. Manual handling with human labor is carried out without the use of PPE, namely back support, which may be caused by non-compliance with the use of PPE (Deros et al., 2015; Et. al., 2021; Goode et al., 2014; Irhamna & Herbawani, 2022; O'Sullivan et al., 2015). According to HIRADC Corporate Affairs HSE, manual handling work/activities are only attached as a risk of a job and not as the main activity. Therefore, HIRADC Corporate Affairs & HSE Office was carried out for manual handling activities, with the identification of the following hazards:

Table 4. Manual Handling Hazard Identification

Activity	Danger
Preparation of transport equipment	Unfit or damaged appliance
	The preparation area is not clean or level

Implementation of manual handling	Overload exceeds maximum capacity
	Loads with sharp surfaces
	Unstable load when moved
5R	Unneatly arranged/scattered areas

There are 6 potential hazards in manual handling activities, including 2 mechanical hazards, 3 ergonomic hazards, and 1 physical hazard.

Risk Identification

a. Grinding

Potential risks due to hazards that can be found are work-related accidents and work-related illnesses. The identified risks were obtained based on the results of field observations and interviews packaged in the following table.

Table 5. Identification of Grinding Risk

Activity	Danger	Risk	Frequency of Occurrence	Severity	Risk Assessment
Grinding Tool Preparation	Cables - cables that are stretched out irregularly in the work area	Stumble	3	1	3
	Uneven surface of the work area	Stumble	5	1	5
	Aircraft components lying on the floor of the work area	Stumble	4	1	4
Grinding	Rotating grinding eyes	Scratched hand	3	2	6
		Severed Hand	3	4	12
	The grinding eye rotates and detaches from the grinder	About the limbs	3	3	9
	Grams of grinding process	Contaminating the eyes	4	2	8

	Sparks from grinders	Burns on the skin	2	1	2
		Eye irritation	3	1	3
	Grinded aircraft components	Hit by a large aircraft component	2	1	2

Continued Table 4.3 Identification of Grinding Risk

		Aircraft components are distorted	2	2	4
	Terminal cable peeled off	Electrocution	3	2	6
	Body position	Low back pain	3	2	6
		Tingling	5	1	5
	Vibration	Hand arm vibration	3	2	6
	Noisy	Tinnitus	3	2	6
		Noise-Induced Hearing Loss (NIHL)	3	1	3
	Residues due to grinding	Respiratory disorders	3	2	6
	Hot objects due to grinding	Blistered hands	3	1	3
Cleaning of grinding waste	Leftover grinding chips	Skin irritation	2	2	4

Based on the results of the risk assessment using HIRADC that has been carried out on the scrap area grinding work of the *Corporate Affairs* & HSE Office of PT GMF AeroAsia Tbk., the following potential hazards were found:

Table 6. Risk Categories and Number of Findings on Scrap Area Grinding

Risk Assessment	Number of Findings
Low Risk	6
Moderate Risk	12
High Risk	2
Continued Table 4.3 Risk Categories and Number of Findings on Scrap Area Grinding	
Extreme Risk	0

Based on the data obtained from the results of the risk assessment that has been carried out, there are 2 hazards that are included in the *high risk* category and must be controlled to reduce the potential risk of danger to moderate or *low risk.* Hazards categorized as *high risk* are hazards that occur quite often in the grinding process in the *scrap area* of the *Corporate Affairs* & HSE Office.

b. Manual Handling

The potential risks that can occur in manual handling activities are not much different from grinding, namely work-related illnesses and work-related accidents. The identified risks were obtained based on the results of field observations and interviews packaged in the following table:

Table 7. Risk Categories and Number of Findings on Scrap Area Grinding

Activity	Danger	Risk	Frequency	Severity	Risk Assessment
Preparation of transport equipment	Unfit or damaged appliance	Injuries due to malfunctioning equipment	3	3	9
	The preparation area is not clean or level	Slipping or falling	2	3	6
Implementation of manual handling	Overload exceeds maximum capacity	Back/Automotive Injuries	3	4	12
	Loads with sharp surfaces	Hand wounds	2	3	6
	Unstable load when moved	Falling items	2	3	6
Continued Table 4.3 Risk Categories and Number of Findings on Scrap Area Grinding					

5R	Unneatly arranged/scattered areas	Stumble	2	3	6
		Misidentification of goods	2	2	4

Based on the results of the risk assessment using HIRADC that has been carried out on the manual handling of *scrap* areas of the Corporate Affairs *& HSE OFFICE* OF PT GMF AeroAsia Tbk., the following potential hazards were found:

Table 8. Categories of Risks and Number of Findings on Manual Scrap Area Handling Work

Risk Assessment	Number of Findings
Low Risk	0
Moderate Risk	5
High Risk	3
Extreme Risk	0

Based on the data obtained from the results of the risk assessment that has been carried out, there are 3 hazards that are included in the *high risk* category and must be controlled to reduce the potential risk of danger to moderate or *low risk.* Hazards that are categorized as *high risk* are hazards that occur quite often in the manual handling process in the *scrap area of the* Corporate Affairs *& HSE* Office.

Risk Control

a. Grinding

Although the HIRADC Corporate Affairs & HSE Office has not listed any grinding work activities, in the actual conditions, risk control efforts have been implemented. Based on the results of risk identification and risk assessment, risk control can be carried out to reduce or minimize the risk figure. Risk control activities are carried out by adjusting field conditions that allow control to be carried out using *a hierarchy of control,* namely elimination, substitution, engineering engineering, administration, and PPE, which are as follows:

Table 9. Risk Control and Calculation of Grinding Control Effectiveness

Activity	Danger	Risk	Control	Hierarchy of control types	Severity	Risk Assessment
Grinding Tool Preparation	Cables - cables that are stretched out irregular	Stumble	Provides cable winders or cable-specific channels	A	I	1

	ly in the work area		so as not to interfere with the work area			
	Uneven surface of the work area	Stumble	Ensure the work area is level and use safety shoes	A	I	1
	Aircraft components lying on the floor of the work area	Stumble	Neatly arranging and organizing aircraft components	A	I	1
Grinding	Rotating grinding eyes	Scratched hand	Use of *safety floves*	A	I	1
		Severed Hand		C	VI	12
	The grinding eye rotates and detaches from the grinder	About the limbs	Installing the grinding eye according to the procedure	C	VI	12

Continued Table 10. Risk Control and Calculation of Grinding Control Effectiveness

	Grams of grinding process	Contaminating the eyes	Use of *face shields* or protective glasses	A	I	1
	Sparks from grinders	Burns on the skin	Using the wearpack	A	I	1

	Eye irritation	using protective goggles	A	I	1
Grinded aircraft components	Hit by a large aircraft component	Using aids such as tongs or a stable workbench	C	VI	12
	Aircraft components are distorted	Securing components with clamping or fastening tools.	C	VI	12
Terminal cable peeled off	Electrocution	Replacing peeling cables or using *insulation covers*	B	II	2
Body position	Low back pain	Paying attention to ergonomic working positions	B	II	2
	Tingling	Provides work rotation to reduce static load	B	II	2

Continued Table 11. Risk Control and Calculation of Grinding Control Effectiveness

Vibration	Hand arm vibration	Using *anti-vibration gloves*, reduce the time of exposure to vibration.	B	II	2
Noisy	Tinnitus	Using *earplugs/earmuffs*	B	II	2
	Noise-Induced	Noise monitoring and	B	II	2

		Hearing Loss (NIHL)	routine checks with audiometry			
	Residues due to grinding	Respiratory disorders	Using a respirator mask	A	I	1
	Hot objects due to grinding	Blistered hands	Using *heat resistant gloves*	A	I	1
Cleaning of grinding waste	Leftover grinding chips	Skin irritation	using gloves during 5R or using ala	A	I	1

From the calculation results, control with a value of 1 indicates that the level of control is very effective in reducing risk. Usually this control is carried out at the source of direct danger or using personal protective equipment (PPE) as the last layer of protection. In the table, examples of control with this value include the provision of PPE, such as *safety gloves, safety goggles*, and *wearpacks*, as well as the implementation of occupational safety procedures, such as *housekeeping* the work area after the use of grinders to prevent tripping. This effectiveness focuses on protecting workers directly from potential hazards while activities are running.

Control with an effectiveness value of 2 - 6 indicates a moderate level of control, in the form of installing patient protection at the source of the hazard, such as the installation of *a double shield* or protector on the hand grinding eye, and the closure of the peeled cable using special cable tape. Administrative efforts or modifications of the work environment are also required in control. Some examples include reducing exposure time to vibrations, replacing peeling wires or covering them with an insulation cover, and installing shields on hazardous sources such as burping eyes.

The effectiveness value of 12 indicates the existence of significant hazards that require higher control, for example the installation of additional protection on large components that are grinded or the use of clamping aids for stability.

b. Manual Handling

Similar to grinding, manual handling activities have not been attached to the HIRADC of the Corporate Affairs & HSE Office. However, based on the results of observations and interviews that have been conducted by researchers, risk control efforts have been applied to *manual scrap* area *handling activities*, based on *the hierarchy of control*, namely elimination, substitution, engineering engineering, administration, and PPE. So, the following risk control is arranged:

Table 12. Risk Control and Control Effectiveness Calculation

Activity	Danger	Risk	Control	Frequency	Severity	Risk Assessment
Preparation of transport	Unfit or damaged	Injuries due to malfunctioning	Regular inspection and	A	I	1

equipment	appliance	equipment	maintenance of the appliance			

Continued Table 13. Risk Control and Control Effectiveness Calculation

	The preparation area is not clean or level	Slipping or falling	Keeping the area clean	A	I	1
Implementation of manual handling	Overload exceeds maximum capacity	Back/Auto motive Injuries	Using *back support*	B	II	2
	Loads with sharp surfaces	Hand wounds	Using gloves	A	I	1
	Unstable load when moved	Falling items	Adds hooks and maintains load stability.	A	I	1
5R	Unneatly arranged/scattered areas	Stumble	Tidying up the work area	A	I	1
		Misidentification of goods	Labeling and checking of goods routinely	A	I	1

From the results of the risk control calculation, a low risk category (Value 1-2) was obtained. A risk with this value indicates that the controls applied are effective enough to mitigate the hazard. Activities with low residual risk include:

- Periodic inspection of the conveyor to prevent injury due to damaged equipment.
- Keep the preparation area clean to avoid slipping or falling.
- Using back support to handle too heavy loads.
- Use gloves to protect hands from sharp loads.
- Label items regularly to prevent misidentification.

c. Residual Risk

After control efforts are carried out, the next is the calculation of *residual risk* , where the value is used to determine whether the risk requires further control or sufficient control that has been carried out. The calculation *of residual risk* is as follows

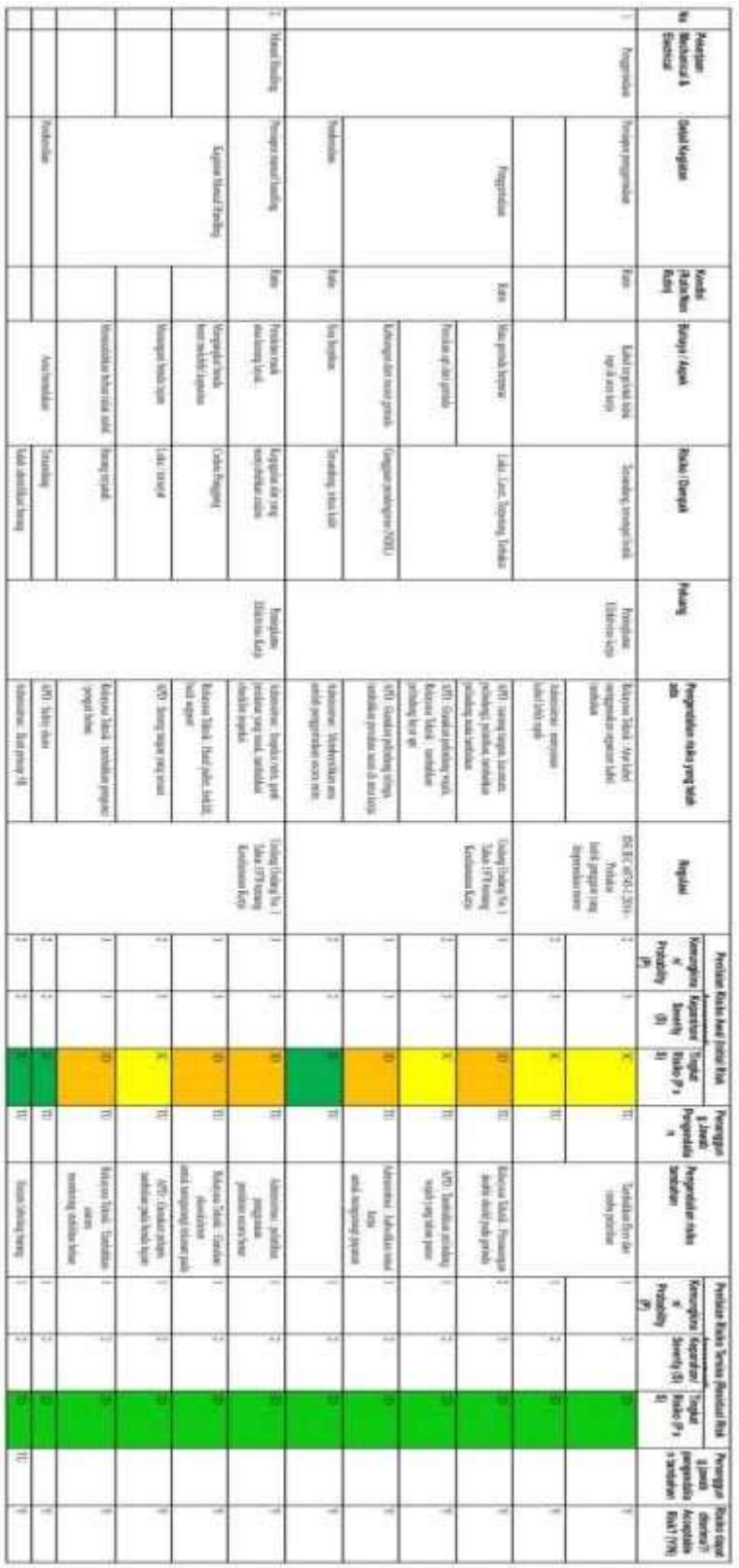
Risk control = risk rating - the level of control of the analysis results, namely:

1. If a final score of 1 is obtained, it means that the control that has been carried out is acceptable and does not need additional control.≤
2. If a final score of 1 is obtained, it means that there is still a risk from the existing processes in grinding and >*manual handling* activities in the *scrap area* of the HSE Corporate Affairs Office, PT. GMF. AeroAsia, Tbk.

4.4 Improvement Efforts

Based on the discussion of these problems, the author seeks to prepare HIRADC for grinding work activities and *Manual handling*. The following are the results of HIRADC in accordance with the Dinas format *General Affairs* & HSE PT. Garuda *Maintenance Facility* AeroAsia Tbk. :

Table 4.1 HIRADC Recommendations



4.5 Obstacles to the Implementation of MBKM by Design FKM UNAIR

The implementation of the Independent Learning Independent Campus Program (MBKM) by Design from the Faculty of Public Health (FKM) Universitas Airlangga at PT. GMF AeroAsia Tbk. provides great benefits for students in integrating theory with field practice. However, like other programs, its implementation is not spared from various obstacles, including:

1. Implementation Time Limitations:

   The limited duration of the program is not enough to explore the implementation of all aspects of K3 at the work site. Students must adapt quickly to understand the work environment and complete assigned tasks.
2. Differences in Standards and Work Systems:

   Operational standards at PT. AeroAsia's GMF which refers to international aviation industry regulations, such as EASA and FAA, requires further adaptation from students. This sometimes makes it difficult for students who are not familiar with the standard.

Conclusion

The MBKM Kesmas by Design program at PT GMF AeroAsia Tbk. offers students hands-on experience by applying theoretical knowledge from courses like Risk Management, Ergonomics, K3, Industrial Hygiene, Toxicology, Research Methodology, PAK, AKLPB, and MBKM by Design to real-world occupational safety and health (OSH) challenges, enabling them to identify, analyze, and mitigate workplace risks through methods such as HIRADC analysis, ergonomic assessments, environmental health measurements, and emergency response planning. While the program effectively integrates data-driven risk management, areas for improvement include documentation, training, and risk control for optimal hazard mitigation. Future research should investigate the long-term impact of the program on students' professional skills and workplace safety through longitudinal or comparative studies, explore advanced risk management strategies (e.g., digital hazard monitoring and targeted training), and assess the program's scalability across industries to enhance OSH practices more broadly.

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