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Analyses of Critical Success Factors and Barriers to the Implementation of Indonesian Mining Safety Management System: Case Study of a Nickel Mine & Processing Company

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ABSTRACT

A very high level of work risk makes the implementation of an occupational health and safety management system imperative, particularly for mining businesses. Because it has an impact on the business's performance, sustainability, and reputation, mining safety is an issue of critical importance. The Republic of Indonesia's government has enacted regulations requiring the Mineral and Coal Mining Safety Management System (SMKP MINERBA) to be applied, as detailed in MEMR Regulation No. 26 of 2018 and its derivatives, through the Ministry of Energy and Mineral Resources (MEMR). The implementation of SMKP MINERBA, however, is still insufficient as shown by the rise in mining accidents that result in harm, lost productivity, and even fatalities. The study came to the conclusion that the existing CSFs could be categorized using the seven factors: SMKP good governance; strong organizational safety culture; organizing and resource availability; Specific - Measurable - Attainable - Relevant - Time Bound (SMART) planning and periodic monitoring; management commitment and strategy; effective Occupational Health & Industrial Hygiene (OH-IH) management; and compliance and safety leadership. In the meantime, the barriers may be classified as follows: low SMKP management commitment, inadequate safety leadership, and poor OHS strategy and execution. Rankings of CSFs and Barriers were also established using the Relative Importance Index (RII), and the ratings might be used by Management to enhance the organization further. As a consequence, the findings of this study and the solutions offered are beneficial to the industry since they may increase practitioners' knowledge and support them in expanding their acceptance in organizations

INTRODUCTION

One of the most important areas for the prosperity of a country is the mining industry, which is unique in nature and features compared to other businesses. In the mining industry, large investment costs (capital intensive), long-term, high and unique risks, high unpredictability, and dynamic conditions (hazard & switched risk) are required. These characteristics, together with efforts to increase productivity in order to meet substantial demand, may have unfavorable effects, such as an increase in work accidents due to pressure on production goals.

According to data from the Directorate General of Mineral and Coal, Director of Engineering and Environment (DTEMC) of the Ministry of Energy and Mineral Resources MEMR (2022), there were 1642 reports of mining-related incidents with different types, ranging from mild to fatal accidents, in a ten-year period. This makes the mining industry the most dangerous work sector in Indonesia. Figure 1 displays information on mining accidents from 2012 through 2021. Up to 883 persons suffered significant injuries, and 224 miners lost their lives. Cases that could have been kept quiet or not reported are not included in this

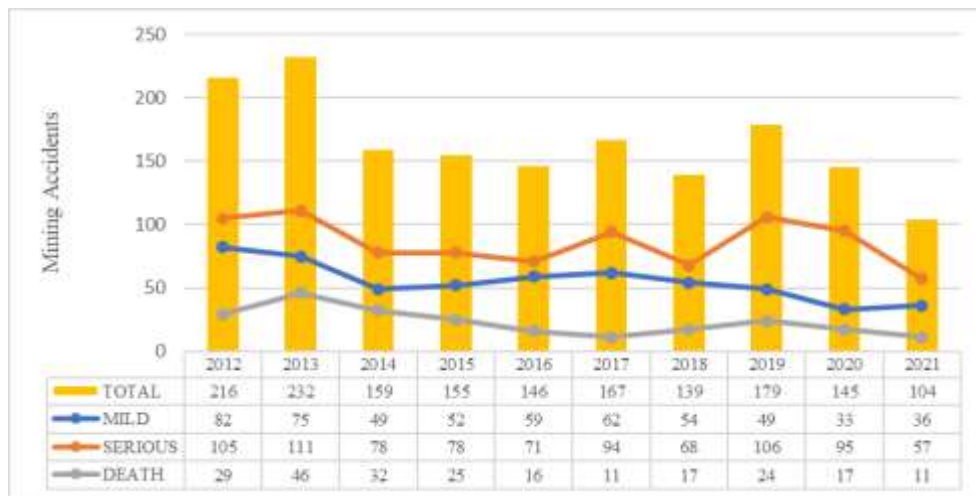


Figure 1. Indonesia’s Mining Accident Statistics for 2012–2021

According to statistics from the Indonesian Mining Safety Professional Association (2022), there has been a rise in work-related accidents in Indonesia's

mining industry over the past five years that have resulted in major injuries or fatalities. This is demonstrated by the Frequency Rate (FR) in Figure 2 and the Severity Rate (SR) in Figure 2

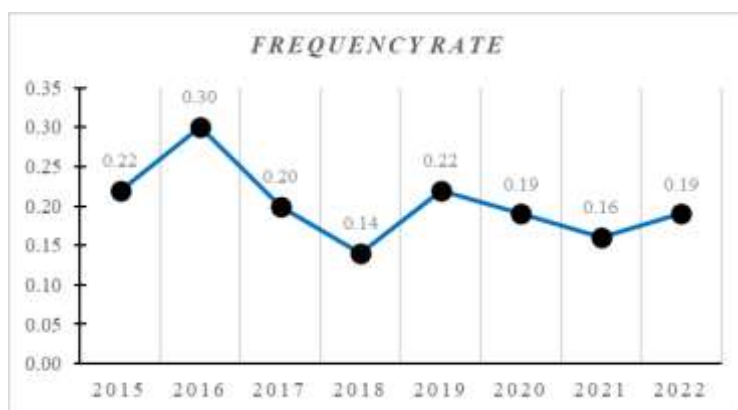


Figure 2. Mining Accidents Frequency Rate for 2015 – 2022

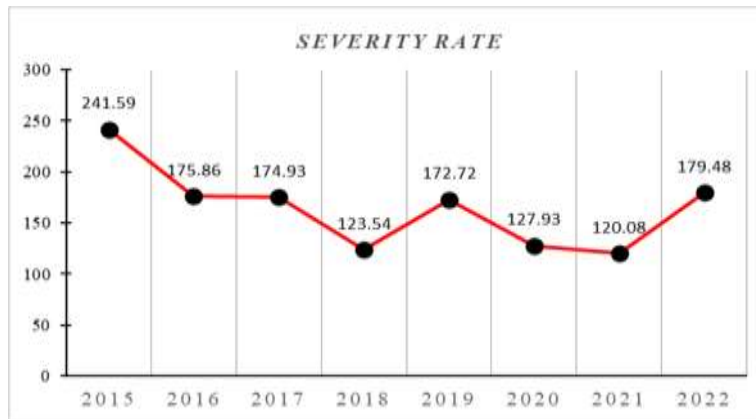


Figure 3. Mining Accidents Severity Rate for 2015 – 2022

As a nickel mining and processing firm, PT. XYZ's experiences are consistent with the statistics previously mentioned. The Total Recordable Injury Frequency Rate (TRIFR) curve in Figure 4 has been gradually reversing upward from 2018, according to corporate data (2022). TRIFR serves the same purpose as FR in safety statistics by calculating the frequency of injuries that need to be reported. The

TRIFR statistic describes how frequently work-related illnesses or injuries may be reported for each million hours worked. In the end, one mortality occurrence concerning a contractor's employee occurred in 2022. This statistic shows a management control system's first line of defense has failed, causing a constant rise in mining accidents as a result.



Figure 4. TRIFR VS Fatality 2012 – 2021

Accidents in the mining industry undoubtedly result in significant costs for businesses and people, both individually and collectively. In order to decrease accidents at work, risks and dangers should be handled and controlled. By determining possible dangers in the workplace, efforts to control hazards must be made (Suma'mur, 2011). Workplace accidents will directly affect productivity loss, time, and every person involved in the task. Therefore, raising safety standards will have excellent financial results (Delfani, 2018). Despite

the fact that effective safety management is crucial, many developing nations do not give it enough thought (Durdyev et al., 2017). According to Sutawijaya et al. (2017), the lack of a strong safety culture in society prevents Indonesia from fully implementing the Occupational Health and Safety Management System (OHSMS). Occupational health and safety management systems (OHSMS) are used to manage occupational health and safety through a management system approach to implement effective results in avoiding accidents and

other negative effects (Ramli, 2010). On the other hand, global market competition necessitates that an industry further develop its business by improving its **OHSMS**

According to MEMR Regulation No. 26 of 2018 and its derivatives, the government of the Republic of Indonesia (GOI) has also enacted regulations requiring the Mineral and Coal Mining Safety Management System (SMKP MINERBA) to be mandatorily established. MEMR urged mining companies to embrace best practices to foster an environment that supports environmentally responsible mining. In order to mitigate the risks to mining safety, SMKP MINERBA is a component of the company's overall management system (MEMR Regulation No. 26, 2018). SMKP MINERBA is now regarded as the finest protection against mining

mishaps that resulted in injuries and fatalities as an OHSMS for the mining sector. The integration of the Mining Operational Safety (KO), Mining Occupational Health and Safety (K3), and the environment in mining is another goal of this system (Sumarno, 2018). The primary actions that must be taken to preserve workplace safety are described as efforts to promote mining's ongoing safety and compliance with safety standards (Neal & Griffin, 2012). However, despite the fact that a new SMKP MINERBA legislation has been in existence for three years, it was discovered that mining companies are still having trouble putting it into practice. SMKP MINERBA fulfillment is on the decline nationally; in 2021, the average was just 51% (DTEMC, 2022). Figure 5 depicts the circumstance when SMKP MINERBA's implementation is inadequate.

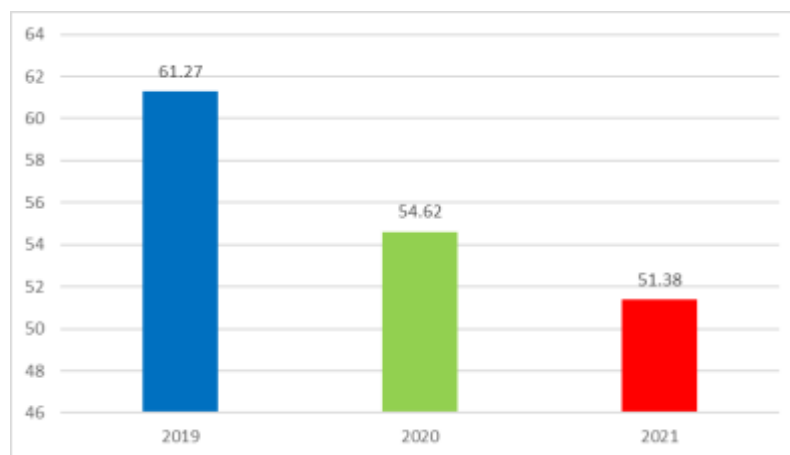


Figure 5. National Average Value of SMKP MINERBA Audit Results for 2019 – 2021

Additionally, those circumstances are depicted inside PT. XYZ. Figure 6 illustrates the findings of the SMKP Audit review, which also revealed a poor score, particularly for mining services contractors within PT. XYZ, ranging from 30 - 70%. The average compliance is still below 60%, which indicates that the implementation of SMKP MINERBA is still in a low state based on the data that is currently available. According to Anggoro & Simorangkir (2019), there are several barriers that businesses implementing SMKP

MINERBA frequently encounter. These include: 1) Internal company factors, such as a lack of understanding, a lack of management support, and an unstable workforce; 2) Difficulties managing a mining service company); 3) Nature of the Company, such as a lack of resources and unfamiliarity with the system concept; 4) Inadequate audit implementation. and 5) The absence of programs and information from the government's regulatory agencies.

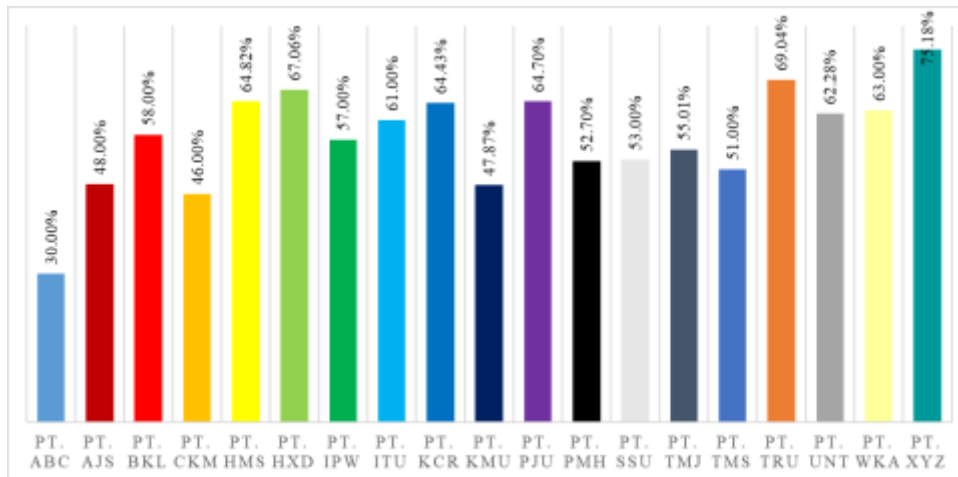


Figure 6. SMKP MINERBA Internal Audit Score Result of PT. XYZ and Contractors for the 2021 Period

It has been acknowledged that critical success factors (CSFs) for management systems are highly helpful in enhancing OHS performance. If CSF is correctly implemented and carried out, it has the potential to assess the effectiveness of the organization's performance of its plan (Rockhart, 1979). In order to achieve performance goals, managers must pay greater attention to limitations that may be identified using the CSF concept (Corkindale, 2013).

The goal of this study is to identify the CSFs and barriers to SMKP MINERBA deployment. This is crucial since they have not adequately recognized and implemented CSF, which has made it difficult to build a safety management system (da Silva & Amaral, 2019). The CSF is a crucial success element that the company must take into account in order for the strategy design's execution to succeed (Buniya et al., 2021). It is vital to assess crucial success factors that significantly contribute to the successful implementation of SMKP MINERBA in businesses since it is anticipated that this research will assist in resolving issues with the underutilized SMKP MINERBA implementation.

A thorough research is required to create a model for implementing an occupational safety and health management system, particularly in nickel mining and processing firms in Indonesia, as there are only a few studies and theories that cover the application of SMKP MINERBA. Factor analysis is one of the research techniques that has been widely employed in prior studies of a comparable nature and is thought to be adequate and appropriate. In the multivariate statistical approach, factor analysis is a strategy for reducing the amount of data as well as a tool for evaluating measuring devices (Watkins, 2018). By integrating factors or dimensions that are connected or have correlations in a new, more focused data structure, factor analysis, which necessitates interrelationships between variables, theoretically simplifies the varied and complex relationships of the observed variables. The Exploratory Factor Analysis (EFA) technique was selected for this investigation since it is well-known and relatively simple. The data provided are often measurements with a number of variables. The EFA method was used to analyze the survey data, which also assisted in reducing the number of factors and establishing correlations among variables (Hair et al., 2010).

METHODS

In order to answer the proposed research questions, the researcher develop Research Framework as seen on Figure

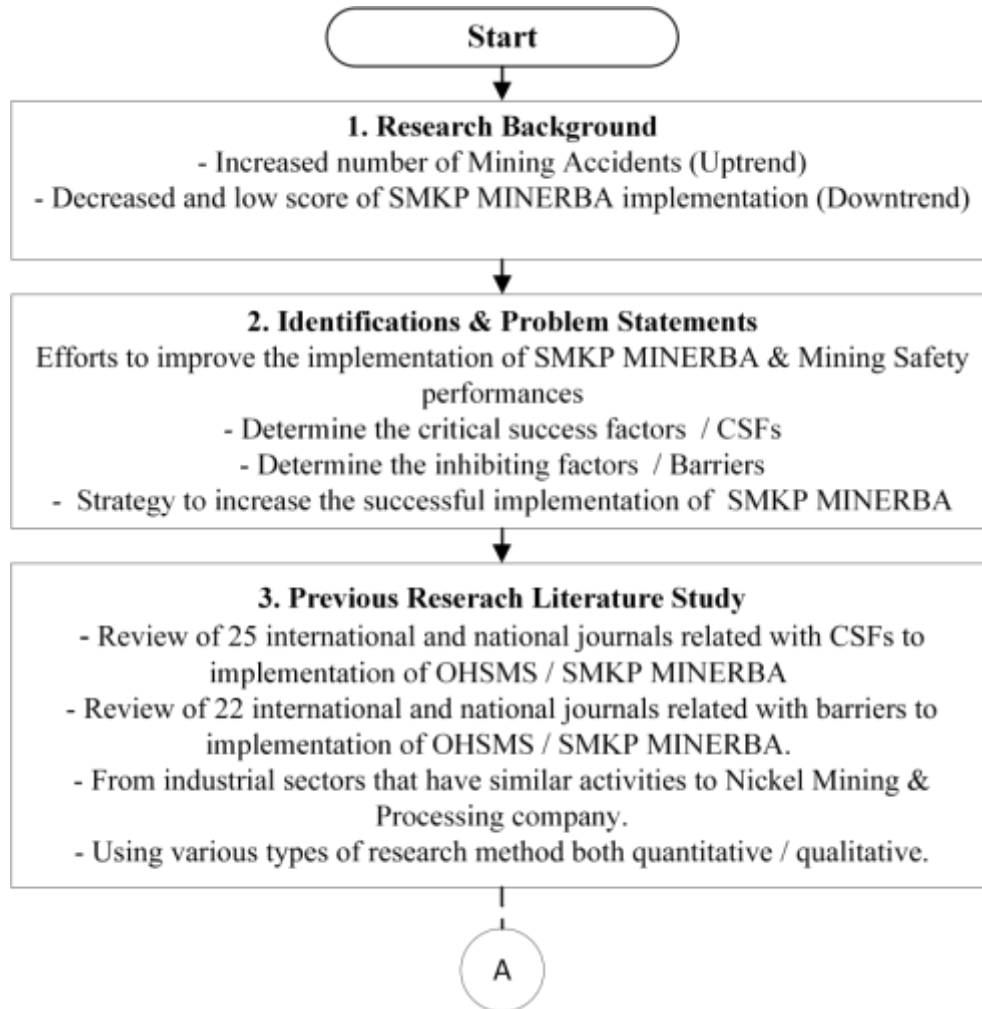


Figure 7. Research Framework

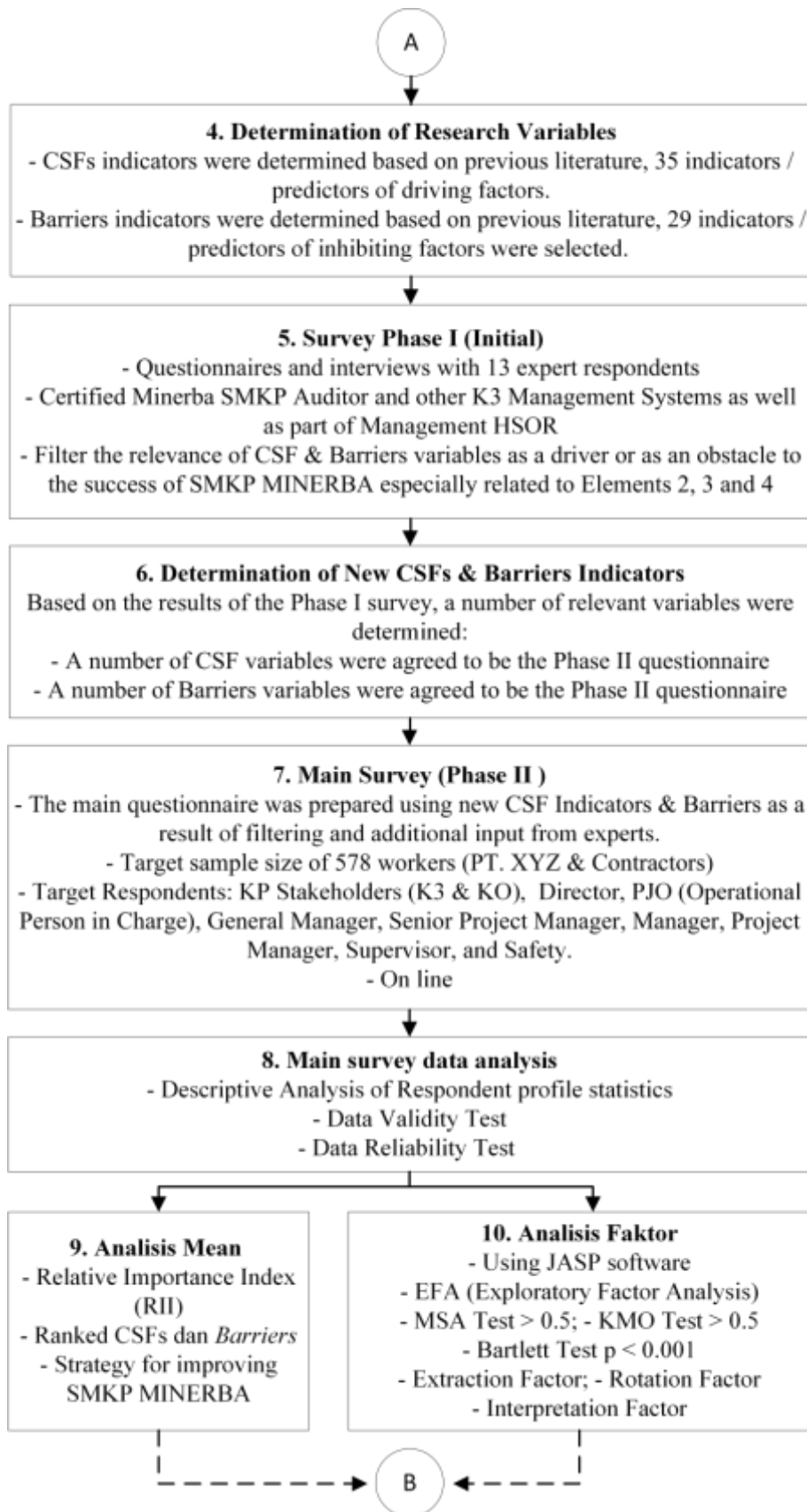


Figure 8. Research Framework (Continued 1)

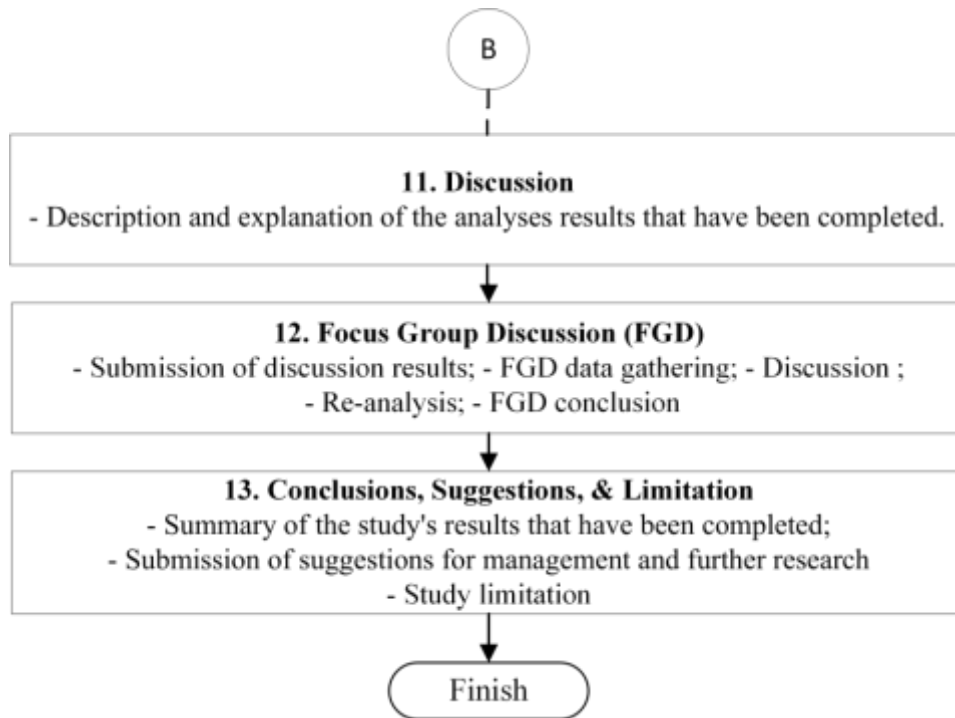


Figure 9. Research Framework (Continued 2)

RESULTS AND DISCUSSION

1. Factor Analysis of CSFs

Several value criteria in factor analysis using JASP need to be evaluated and fulfill the standards in order to be certified valid and eligible for further analysis. The Bartlett Test of Sphericity is the fundamental premise of factor analysis. The

JASP calculations produced an X^2 value of 3041.070 at $df = 378$ and $p < 0.001$ as a consequence. Given that both the significance level and the Chi-Squared test, both of which are displayed in Table 1, are less than 0.05 (5%), this demonstrates that the tested data are correlated and match the prerequisites for component analysis

Table 1. Bartlett's Test & Chi-Squared Test of CSFs Indicators

Bartlett's test		
X²	df	p
3041.070	378.000	< .001

Chi-squared Test		
Value	df	p
Model 325.403	203	< .001

The Kaiser Meyer Olkin Measure of Sampling (KMO) is an indicator for comparing the separation between the correlation coefficient and its partial correlation coefficient, according to the second-factor analysis assumption. The KMO value will be near to 1 if the sum of the squares of the

partial correlation coefficients for all pairs of variables is low compared to the sum of the squares of the correlation coefficients. If the KMO number is more than 0.5, it is deemed adequate. Table 2 displays the outcomes of the KMO.

Table 2. KMO-MSA Test of CSFs Indicators

Kaiser-Meyer-Olkin test	
	MSA
Overall MSA	0.874
X1	0.841
X2	0.906
X3	0.819
X4	0.938
X5	0.871
X6	0.885
X8	0.856
X9	0.879
X10	0.813
X12	0.853
X13	0.895
X14	0.863
X15	0.875
X16	0.778
X17	0.941
X18	0.869
X19	0.924
X20	0.860
X21	0.842
X22	0.871
X23	0.518
X28	0.742
X29	0.745
X30	0.912
X32	0.954
X33	0.841
X34	0.948
X35	0.908

Based on the findings, the MSA value was 0.874. Because it has a value higher than 0.5, the KMO standards have therefore been satisfied. The majority of the question items, including X16, X28, and X29, have MSA values greater than or equal to 0.8, which indicates that they are Good. The number that is closest to 0.5 even applies to X23. Since all variables were found to pass the MSA Requirements Test and have a value greater than 0.5, they may all be used in future analyses.

In addition, factor analysis using Exploratory Factor Analysis (EFA) was performed to determine how many components were created from a measuring tool made up of a number of questionnaire questions. Principal Component Analysis (PCA) and EFA are both factor analysis techniques, although EFA uses a distinct mathematical procedure. The procedure used to reduce the original collection of variables to simpler components employs the Eigenvalues and Scree Plot criteria in addition to the prerequisites and assumptions like the KMO-MSA and the Bartlett Test mentioned before, as illustrated in Figure 3.

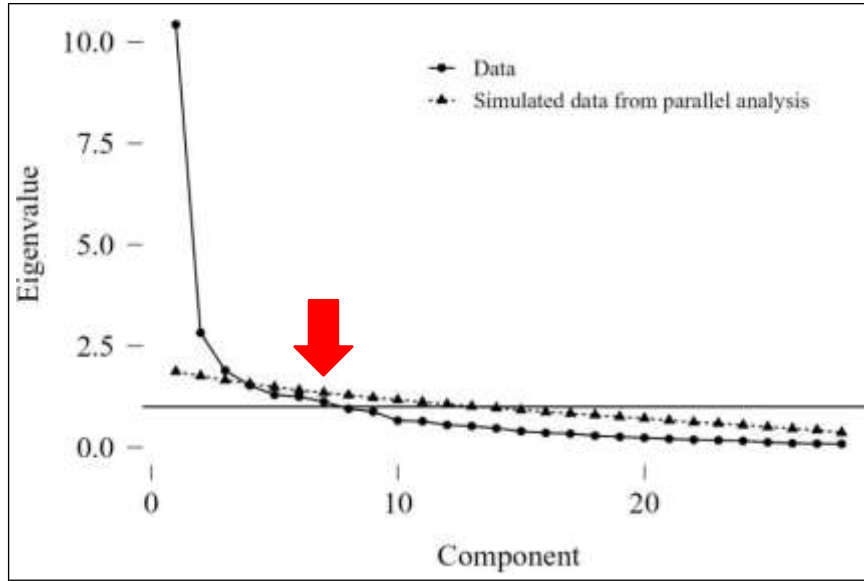


Figure 10. SMKP MINERBA Scree Plot Factor Analysis CSFs

Figure 8 above shows how the Scree plot based on the Eigenvalue, which is demonstrated by subtracting the curve until it is sloping and yet above the Eigenvalue = 1 line, would corroborate the construction of the number of components. Consequently, there are only 7 (seven) points total, or the number of components generated, if we count the points starting from the left side. The study yields

7 distinct factors, which are divided into groups based on how each question item's loading factor value relates to the others. Setting the default loading value above 0.4, although researchers may alter based on the respective assumptions made, whether it is stricter or the minimum employs the number 0.3. The Table 3 below shows the value of factor loading.

Table 3. CSFs Analysis Result of SMKP MINERBA

Factor	Name	Variable		Factor Loading
1	<i>SMKP Good Governance</i>	X12	Pelaksanaan Audit SMKP MINERBA yang diselesaikan versus rencana dan tindak Lanjut hasil Audit SMKP MINERBA yang memadai	0.848
		X13	Rapat / Pertemuan rutin Keselamatan Pertambangan	0.847
		X6	Insentif dan Inovasi penghargaan terkait Award Keselamatan Pertambangan	0.841
		X5	Penetapan Kebijakan Keselamatan Pertambangan dan Prosedur keselamatan pertambangan, standar teknis, dan Izin Kerja Khusus yang berkaitan dengan pekerjaan.	0.786
		X34	Sosialisasi SMKP MINERBA kepada Manajemen Tingkat Puncak Perusahaan;	0.647
2	Strong Organizational Safety Culture	X20	Manajemen Risiko dan Rencana tanggap darurat (ERP)	0.79
		X22	Rencana Kerja dan Program pelaksanaan SMKP MINERBA	0.781
		X21	Inspeksi K3 dan Uji Kelayakan Alat (KO)	0.772
		X19	Budaya keselamatan Organisasi yang kuat	0.732
		X17	Terdapat Tujuan, Sasaran, Program SMKP MINERBA yang jelas	0.501
3	<i>Organizing and Resource availability</i>	X14	Contractor Safety Management System (CSMS) sebagai bagian dari SMKP MINERBA	0.838
		X8	Perencanaan organisasi dan sumber daya yang memadai, termasuk pembentukan Komite Keselamatan Pertambangan yang berperan aktif untuk pengelolaan SMKP MINERBA	0.827
		X35	Penetapan Kriteria Minimal Implementasi SMKP MINERBA untuk Perusahaan Jasa Pertambangan	0.735
		X15	Pelaporan, pencatatan, dan Investigasi kecelakaan kerja dan tindak lanjut perbaikan. (Termasuk kejadian berbahaya / nyaris celaka)	0.458
		X9	Pengelolaan SPIP (Sarana, Prasarana, Instalasi, Peralatan) yang baik.	0.479
4	<i>SMART Planning & Monitoring</i>	X3	Promosi, komunikasi, informasi, dan sosialisasi terkait kegiatan berhubungan dengan SMKP MINERBA	0.810
		X18	Investasi dan Anggaran SMKP MINERBA yang memadai	0.779
4	<i>SMART Planning & Monitoring</i>	X33	Pengawasan dan Pembinaan dari Inspektur Tambang (Pemerintah)	0.740
		X2	Pemenuhan Pelatihan dan Kompetensi kebutuhan SMKP MINERBA	0.474
		X4	Identifikasi Bahaya dan Penilaian Risiko Proses Bisnis dan Pekerjaan	0.359
	<i>Management</i>	X1	Komitmen dan dukungan Manajemen terhadap pelaksanaan SMKP MINERBA	0.669
		X3	Seleksi dan penempatan personil	0.553

5	<i>Commitment & Strategy</i>	0		
		X3 2	Penggunaan teknologi informasi dan teknologi jaringan dalam SMKP MINERBA	0.432
6	<i>Efficient OH-IH Management</i>	X16	Pengelolaan Kesehatan Kerja yang memadai	0.953
		X10	Ketersediaan tim IH yang secara berkala menguji lingkungan kerja aman dan ergonomi	0.631
7	<i>Compliance & safety leadership</i>	X29	Pemenuhan standar dan jangka waktu pemberian alat pelindung diri (APD) kepada karyawan;	0.759
		X28	Telaah undang-undang dan peraturan pemerintah yang berlaku untuk menjadi bagian integral dari SMKP MINERBA	0.745
		X23	Kepemimpinan KTT / PJO (termasuk Delegasi, Otoritas, dan Tanggung Jawab)	0.491

2. Factor Analysis of Barriers

The Bartlett Test produced an X^2 value of 2148,676 at $df = 153$, with $p < 0.001$, for the barrier factor analysis of the implementation of SMKP MINERBA. The significance is below 0.05 (5%),

and the Chi-Squared test, as shown in Table 4 below, also demonstrates that the data examined are correlated data and match the conditions for factor analysis.

Table 4. Bartlett's Test & Chi-squared Test of Barriers Indicators

Bartlett's test			
	X^2	df	p
	2148.676	153.000	< .001
Chi-squared Test			
	Value	df	p
Model	332.037	102	< .001

According to the findings, the MSA value was 0.880. Because it has a value higher than 0.5, the KMO standards have therefore been satisfied. The majority of each question item's MSA value is > 0.8 ,

which indicates Good. Since all variables were found to pass the MSA Requirements Test and have a value greater than 0.5, they may all be used in future analyses. Table 5 displays the outcomes of the KMO.

Table 5. KMO – MSA Test of Barriers Indicators

Kaiser-Meyer-Olkin test	
	MSA
Overall MSA	0.880
B1	0.860
B2	0.769
B3	0.902

B4	0.855
B10	0.919
B12	0.787
B13	0.884
B15	0.788
B16	0.898
B18	0.964
B19	0.933
B20	0.907
B22	0.939
B24	0.830
B26	0.881
B27	0.921
B28	0.900
B30	0.831

When the curve is subtracted until it is sloped and still above the Eigenvalue = 1 line in Figure 9, the Scree plot based on the Eigenvalue also confirms the development of the number of factors.

Therefore, there are only 3 (three) elements generated if we count the points starting from the left side. (The eigenvalue's fourth point is <1)

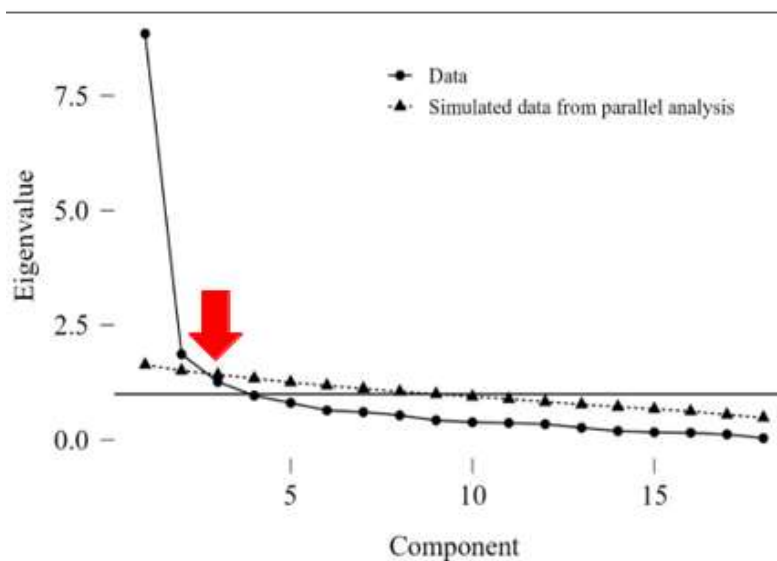


Figure 11. Scree Plot of Factor Analysis of Barriers to SMK MINERBA

The study yields three distinct factors, which are divided into groups based on the correlation between the factor loading values for each question item. To display all loading factors, the default

loading value option utilizes the value 0.38. Table 6 displays the components that make up each group as well as the individuals that make up each category.

Table 6. Barriers Factor Analysis Results of SMKP MINERBA

Factor	Name	Variable	Factor Loading	
1	Low Management Commitment	B13	kegagalan dalam Analisis Risiko dan Pengambilan Keputusan yang tidak tepat dalam implementasi SMKP MINERBA	0.793
		B12	Kesulitan dalam mengelola Kontraktor / Jasa Perusahaan Pertambangan dalam menerapkan SMKP MINERBA	0.764
		B2	Kurangnya Komitmen dan partisipasi manajemen dalam Implementasi SMKP MINERBA	0.761
		B1	Kurangnya pemahaman dan pelatihan terkait Implementasi SMKP MINERBA	0.736
		B16	Tinjauan manajemen belum dilaksanakan sehingga kesulitan dalam mendefinisikan indikator manajemen yang tepat dalam penerapan SMKP MINERBA	0.671
		B10	Kesulitan dalam telaah Peraturan tidak perundangan sehingga dilaksanakan secara konsisten.	0.67
		B22	Tidak/belum ada Komite Keselamatan Pertambangan yang ditetapkan	0.56
		B19	Komunikasi dan Informasi yang kurang terkait pelaksanaan SMKP MINERBA	0.363
2	Poor Safety Leadership	B30	Insentif dan Penghargaan Keselamatan Pertambangan kurang memadai	0.833
		B24	Kurangnya sanksi / <i>law enforcement</i> terhadap pelanggaran SMKP MINERBA	0.784
		B28	Resistensi dalam perubahan dan hambatan dalam penggunaan integrasi teknologi dalam pelaksanaan SMKP MINERBA	0.756
		B15	Tidak terbiasa dan kurangnya kesiapan untuk mengadopsi sistem manajemen SMKP MINERBA	0.692
		B18	Kurangnya Standar Prosedur dan integrasinya ke SMKP MINERBA	0.66
		B27	Tidak optimalnya pelaksanaan studi dan audit SMKP MINERBA	0.599
		B3	Keterbatasan biaya atau kurangnya anggaran dan biaya implementasi SMKP MINERBA	0.599
3	Weak Planning and execution	B26	Tindak lanjut dan hasil evaluasi / audit SMKP MINERBA belum diterapkan	0.805
		B20	Lemahnya strategi pengadaan dan kurangnya Klausul Kontrak untuk penerapan sistem manajemen kepada kontraktor	0.758
		B4	Kurangnya tenaga ahli / sumber daya SMKP MINERBA terbatas	0.691

3. Relative Importance Index (RII) and Focus Group Discussion (FGD)

The Relative Importance Index (RII) approach may be used to assess the findings of the stage II questionnaire so that it can be determined which factors are most encouraging and hindering the implementation of SMKPMINERBA. Based on the weighted average of the Respondents' values on the Likert scale, RII assigns a ranking. The following equation is used to compute the RII formula:

$$RII = \sum W / (A \times N)$$

Where:

- RII = Relative Importance Index
- W = Weight (Number of answers on Weight with a range of 1 to 5 according to the Likert Scale * weight)
- A = highest weight (5)
- N = total respondents

FGDs were also performed to support the study's findings, particularly the ranking of CSFs and

Barriers, the outcomes of which will have management ramifications for the future implementation of SMKPMINERBA. Experts and respondents with expertise in SMKPMINERBA and the Health, Safety & Risk Management of PT. XYZ participated in the FGD session. There were 13 participants in the FGD that took place on January 13, 2023, from 16:30 to 17:30 at the Savvy HRTM PT. XYZ.

FGD was employed in this study as a secondary way of data collecting and as a type of triangulation method technique to guarantee that the data gathered are legitimate data by re-comparing the level of certainty in information from various sources (Moleong, 2014). Comparisons were made between the findings of the RII survey and RII FGD figures. For both CSFs and barriers, there were discrepancies in ranking between the RII Survey and RII FGD, as shown in Table 7 for CSFs.

Table 7. Comparison of CSF Ranking Results Between RII Survey and RII FGD

Kode	Description	RII (Survey)	Rank (Survey)	RII (FGD)	Rank (FGD)
X3	Promosi, komunikasi, informasi, dan sosialisasi terkait kegiatan berhubungan dengan SMKPMINERBA	0.717	10	0.192	10
X14	<i>Contractor Safety Management System</i> (CSMS) sebagaibagian dari SMKPMINERBA	0.803	3	0.346	9
X33	Pengawasan dan Pembinaan dari Inspektur Tambang(Pemerintah)	0.774	6	0.369	8
X12	Pelaksanaan Audit SMKPMINERBA yang diselesaikanversus rencana dan tindak Lanjut hasil Audit SMKPMINERBA yang memadai	0.775	5	0.431	7
X4	Identifikasi Bahaya dan Penilaian Risiko Proses Bisnis danPekerjaan	0.718	8	0.515	6
X17	Terdapat Tujuan, Sasaran, Program SMKPMINERBA yangjelas	0.718	8	0.623	5
X8	Perencanaan organisasi dan sumber daya yang memadai, termasuk pembentukan Komite Keselamatan Pertambanganyang berperan aktif untuk pengelolaan SMKPMINERBA	0.781	4	0.669	4
X2	Pemenuhan Pelatihan dan Kompetensi kebutuhan SMKPMINERBA	0.825	1	0.677	3

X5	Penetapan Kebijakan Keselamatan Pertambangan dan Prosedur keselamatan pertambangan, standar teknis, dan IzinKerja Khusus yang berkaitan dengan pekerjaan.	0.718	7	0.700	2
X1	Komitmen dan dukungan Manajemen terhadap pelaksanaanSMKP MINERBA	0.821	2	0.977	1

Many of the variables are still in the same position or have just slightly changed, while some have undergone jumps. The primary survey respondents' varying assumptions/perceptions about an item predictor questionnaire may be the cause of this, which is why the data analysis findings seem to be dependent on the information provided. The experts claim that although the findings of the RII Survey were based on the assumption that "Important" was either a CSF or a barrier, the results of the RII FGD with specialists showed an extra sense of "Urgency" that needed to be followed up right away. Following a lively discussion with management and subject matter experts during the FGD, it was decided to "cross" the RII to create a new rating, which, when plotted, resembled the Eisenhower Matrix. Figure 10 displays the outcomes

of the FGD choices for ranking RII calculations on CSF for the implementation of SMKP MINERBA.

Additionally, the RII CSF values from the survey findings and the RII CSFs from the FGD results are multiplied to provide the final RII CSFs ranking for the implementation of SMKP MINERBA. The findings of the Final RII score for variable X2 are, for instance, $0.825 \times 0.677 = 0.558$ based on the data from Table 7 and the results obtained for variable X2 Fulfillment of Training and Competency Needs of SMKP MINERBA, with a RII Survey of 0.825 and a RII of FGD of 0.677. The top 10 scores of the Final RII and the Final Ranking of the CSF variables were therefore determined using this formulation. Table 8 displays the final score results for the top 10 RII CSFs as well as the SMKP MINERBA CSF rankings following the FGD



Figure 12. Bubble Plot Diagram of RII CSF SMKP MINERBA at Final Stage

Table 8. Final Score and Ranking of RII CSF to the Implementation of SMKP
MINERBA

Code	Variable	RII Final	Rank Final	Management Strategy
X1	Komitmen dan dukungan Manajemen terhadap pelaksanaan SMKP MINERBA	0.802	1	Must Do Immediately
X2	Pemenuhan Pelatihan dan Kompetensi kebutuhan SMKP MINERBA	0.558	2	Must Do Immediately
X8	Perencanaan organisasi dan sumber daya yang memadai, termasuk pembentukan Komite Keselamatan Pertambangan yang berperan aktif untuk pengelolaan SMKP MINERBA	0.523	3	Must Do Immediately
X5	Penetapan Kebijakan Keselamatan Pertambangan dan Prosedur keselamatan pertambangan, standar teknis, dan Izin Kerja Khusus yang berkaitan dengan pekerjaan.	0.503	4	Must Do Immediately
X17	Terdapat Tujuan, Sasaran, Program SMKP MINERBA yang jelas	0.447	5	Must Do Immediately
X4	Identifikasi Bahaya dan Penilaian Risiko Proses Bisnis dan Pekerjaan	0.370	6	Scheduled ASAP (As Soon As Possible)
X12	Pelaksanaan Audit SMKP MINERBA yang diselesaikan versus rencana dan tindak Lanjut hasil Audit SMKP MINERBA yang memadai	0.334	7	Scheduled ASAP
X33	Pengawasan dan Pembinaan dari Inspektur Tambang (Pemerintah)	0.286	8	Scheduled ASAP
X14	Contractor Safety Management System (CSMS) sebagai bagian dari SMKP MINERBA	0.278	9	Scheduled ASAP
X3	Promosi, komunikasi, informasi, dan sosialisasi terkait kegiatan berhubungan dengan SMKP MINERBA	0.138	10	Scheduled ASAP

Comparisons were also made between the RII FGD figures and survey responses concerning barriers. As indicated in Table 9, there were variations in the rankings of the barriers variable between the RII Survey and RII FGD. The rankings of several other variables have changed, however, variables B1 and

B2 remain in the same position or have just slightly changed. The major survey respondents' differing assumptions and views on an item predictor questionnaire, as stated in the CSFs section, may be the source of this shift, making the output of the data analysis that results extremely dependent on the subjectivity of filling out the questionnaire.

Table 9. Comparison of Barriers Ranking Results Between RII Survey and RII FGD

Kode	Deskripsi	RII SURVEY	RANK SURVEY	RII FGD	RANK FGD
B27	Tidak optimalnya pelaksanaan studi dan audit SMKP MINERBA	0.797	6	0.400	10
B22	Tidak/belum ada Komite Keselamatan Pertambangan yang ditetapkan	0.817	5	0.446	9
B12	Kesulitan dalam mengelola Kontraktor / Perusahaan Jasa Pertambangan dalam menerapkan SMKP MINERBA	0.830	3	0.454	8
B20	Lemahnya strategi pengadaan dan kurangnya Klausul Kontrak untuk penerapan sistem manajemen kepada kontraktor	0.822	4	0.462	7
B26	Tindaklanjut dan hasil evaluasi / audit SMKP MINERBA belum diterapkan	0.739	9	0.508	6
B16	Tinjauan manajemen belum dilaksanakan sehingga kesulitan dalam mendefinisikan indikator manajemen yang tepat dalam penerapan SMKP MINERBA	0.735	10	0.523	5
B13	kegagalan dalam Analisis Risiko dan Pengambilan Keputusan yang tidak tepat dalam implementasi SMKP MINERBA	0.743	8	0.546	4
B1	Kurangnya pemahaman dan pelatihan terkait Implementasi SMKP MINERBA	0.852	2	0.677	3
B4	Kurangnya tenaga ahli / sumber daya SMKP MINERBA terbatas	0.752	7	0.685	2
B2	Kurangnya Komitmen dan partisipasi manajemen dalam Implementasi SMKP MINERBA	0.869	1	0.800	1

The FGD discussion revealed that the reason for the discrepancy in the RII Survey results was that the questionnaire was filled out using only the "Important" weight assumption of the inhibiting factors / Barriers, whereas the results of the RII FGD with experts included an additional element of "Urgency" that needed to be followed up right away.

In order to provide new rankings and charting akin to the Eisenhower Matrix, the RII "cross" between the RII Survey and the RII FGD was conducted. Figure 11 below shows the ratings for the RII calculation of the barriers to the effective implementation of SMKP MINERBA:

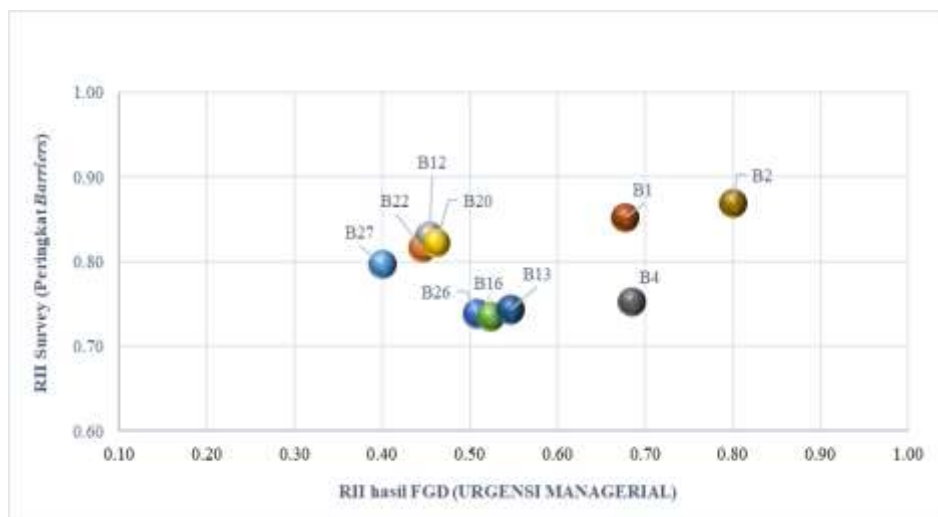


Figure 13. Bubble Plot Diagram of RII Barriers SMKP MINERBA at Final Stage

Table 10. Final Score and Ranking of RII Barriers to the Implementation of SMKP MINERBA

Kode	Variabel Barriers	RII Final	Rank Final	Management Strategy
B2	Kurangnya Komitmen dan partisipasi manajemen dalam Implementasi SMKP MINERBA	0.695	1	Must Eliminate
B1	Kurangnya pemahaman dan pelatihan terkait Implementasi SMKP MINERBA	0.577	2	Must Eliminate
B4	Kurangnya tenaga ahli / sumber daya SMKP MINERBA terbatas	0.515	3	Must Eliminate
B13	Kegagalan dalam Analisis Risiko dan Pengambilan Keputusan yang tidak tepat dalam implementasi SMKP MINERBA	0.406	4	Review & Scheduled ASAP
B16	Tinjauan manajemen belum dilaksanakan sehingga kesulitan dalam mendefinisikan indikator manajemen yang tepat dalam penerapan SMKP MINERBA	0.384	5	Review & Scheduled ASAP
B20	Lemahnya strategi pengadaan dan kurangnya Klausul Kontrak untuk penerapan sistem manajemen kepada kontraktor	0.379	6	Review & Scheduled ASAP
B12	Kesulitan dalam mengelola Kontraktor / Perusahaan Jasa Pertambangan dalam menerapkan SMKP MINERBA	0.377	7	Review & Scheduled ASAP
B26	Tindak lanjut dan hasil evaluasi / audit SMKP MINERBA belum diterapkan	0.375	8	Review & Scheduled ASAP
B22	Tidak/belum ada Komite Keselamatan Pertambangan yang ditetapkan	0.364	9	Review & Scheduled ASAP
B27	Tidak optimalnya pelaksanaan studi dan audit SMKP MINERBA	0.319	10	Review & Scheduled ASAP

CONCLUSION

The findings of this study offer solutions to the problems and goals of the research that were posed. According to the results of the factor analysis conducted for this study, there are 7 (seven) primary components that can be grouped from the 28 predictor items that were found to be driving the effective implementation of SMKP MINERBA in businesses and mining service business contractors at PT. XYZ, including 1) SMKP Good Governance; 2) Strong Organizational Safety Culture; 3) Organizing and Resource Availability; 4) SMART Planning & Monitoring (Specific - Measurable - Attainable - Relevant - Time Bound); 5) Management Commitment & Strategy; 6) Efficient IH-OH Management; 7) Compliance & Safety Leadership. The 17 predictors of success obstacles/barriers to the implementation of SMKP MINERBA in businesses and mining service business contractors at PT. XYZ, however, can be categorized into 3 (three) main factors: 1) Low SMKP management commitment; 2) Poor Safety Leadership; and 3) Insufficient Planning and Execution.

The top 10 rankings are derived from Critical Success Factors using the results of the final analysis of the Relative Importance Index (RII) and strengthened by discussions/focus group discussions with HSE experts and Management. The top 10 rankings are the main barriers to the successful implementation of SMKP MINERBA in the context of mining companies and nickel processing PT. XYZ. All of these factors were combined to provide a number of recommendations for corrective actions that would boost the effectiveness of the SMKP MINERBA deployments in businesses and mining service contractors at PT. XYZ in the upcoming years. The recommendations are as follows: 1) X1 & B2 ~ Strengthening commitment and support, as well as Management's participation in SMKP MINERBA implementation; 2) X2 & B1 ~ Organizing Training and Competency Tests for SMKP MINERBA needs to increase comprehension of SMKP MINERBA implementation using trustworthy instructors; 3) X8 & B4 & B22 ~ Manage mining safety organizations

and resources effectively, including by reviving the Mining Safety Committee, which is actively involved in SMKP MINERBA management, and by addressing the organization's lack of experts and restricted auditor resources; 4) X5 ~ By making the most of the many internal communication channels they currently have, establish and carry out re-socialization of mining safety policies, mining safety procedures, technical standards, and special work permits relevant to mining and processing operations; 5) X17 ~ Provide all levels of employees with defined goals, objectives, and SMKP MINERBA plans, and assign KPIs (Key Performance Indicators) for achieving those goals both on an individual and departmental level; and 6) To undertake reviews, A3 schedule improvements, and routine monitoring using the FMDS (Floor Management Development System) dashboard, a task force team has to be formed for medium- and long-term development initiatives. The following issues need to be followed up: In order to implement SMKP MINERBA effectively, it is necessary to perform the following tasks: a. X4 & B13 ~ Risk Re-analysis of all high-risk activities; establishing appropriate controls and mitigations; b. B16 ~ Perform management reviews on a regular basis so that proper management indicators can be defined; c. X14 & B20 ~ Improving the Contractor Safety Management System (CSMS) as part of SMKP MINERBA to strengthen the procurement strategy and contract clauses; d. X12 & B27 & B26 ~ Fulfilling the completed SMKP MINERBA audit obligations as opposed to planning and monitoring the follow-up of the SMKP MINERBA audit results; e. X33 ~ Asking the Mining Inspector (Government) for supervision and guidance through the SMKP MINERBA Technical Guidance (including to contractors) to assist and supervise Contractors / Mining Service Companies in adopting SMKP MINERBA; f. X3 ~ Enhancing outreach, promotion, information, and communication initiatives for SMKP MINERBA-related activities.

However, there are several shortcomings in this study that must be taken into account and recognized. The following are some of the study's limitations: 1) The subject of the study is limited to a few SMK MINERBA components, namely Element 2 (Planning), Element 3 (Personnel and Organization), and Element 4 (SMK MINERBA Implementation). There is little doubt that not all of the SMK MINERBA's components are represented by the study's findings. The interrelationships between the components, which are virtually universally present in Management Systems, also let that depiction to have been realized. It is strongly advised to conduct more studies to support this. 2) The online data collecting procedure, as well as employee and contractor assessments of the present SMK MINERBA deployment, occasionally do not reflect the respondents' genuine opinions. This occurs because each respondent occasionally has distinct ideas, presumptions, and comprehensions, in addition to other variables like honesty and objectivity in giving feedback. Confirmation by FGD is conducted in order to decrease bias that may emerge from this condition, boost validity, and reinforce study findings. 3) Data analysis is performed solely in its totality and not for each firm, therefore the outcomes of the research and discussion will be more thorough and in-depth. To the company's management, in general, this research offers significant preliminary information on the driving and inhibiting elements in the current implementation of SMK MINERBA as well as approaches to increase the effectiveness of its adoption in the future.

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