ANALYSIS OF EFEECTIVENESS OF CRITICAL CONTROL IMPLEMENTATION USING PLANNED JOB OBSERVATION IN DIVISION X PT. A

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ABSTRACT

International Council of Mining and Metals (ICMM) constructed a framework of Critical Control Management (CCM) to prevent fatality. PT A still experienced the accident with TRIR 0.168 in 2020 then increased 0.176 in 2021. This study aimed to assess the effectiveness of CC in Mining Industry Division X PT A. Semi-quantitative study with descriptive model conducted in Division X PT. A. Data collected according to 5 main variables, namely supervisory system, hierarchy of control implementation, control implementation, policy conformity, and hazards and risks compliance. Primary data was collected from 17 supervisors who had Planned Job Observation (PJO) responsibility through questionnaire and in-depth interviews. Secondary data was HIRADC collected from 11 departments. Data analysis was conducted by descriptive statistical analysis and content analysis. PJO result indicated 20.9% inadequate result related to work practice. Control effectiveness questionnaire signified adequate result for all 5 variables with very suitable result. In addition, in-depth interviews resulted in positive findings in all variables and negative findings for supervisory system, hierarchy of control implementation, and control implementation. Overall, the effectiveness of CC in Division X PT. A still needs to be improved, especially for the aspects of work practice control enforcement and workers' attitude towards CC.

Keywords : Critical Control; Critical Control Management; Control Effectiveness; Planned Job Observation; Work Practice

ABSTRAK

International Council of Mining and Metals (ICMM) telah membangun kerangka kerja Manajemen Kontrol Kritis (Critical Control Management atau CCM) untuk mencegah fatalitas. PT A masih mengalami kecelakaan dengan TRIR 0,168 pada tahun 2020 kemudian meningkat menjadi 0,176 pada tahun 2021. Penelitian ini bertujuan untuk menilai efektivitas Kontrol Kritis (Critical Control atau CC) di Divisi Pertambangan X PT A. Studi semi-kuantitatif dengan model deskriptif dilakukan di Divisi X PT A. Data dikumpulkan berdasarkan 5 variabel utama, yaitu sistem supervisi, implementasi hierarki kontrol, implementasi kontrol, kesesuaian kebijakan, dan kepatuhan terhadap bahaya dan risiko. Data primer dikumpulkan dari 17 supervisor yang memiliki tanggung jawab Planned Job Observation (PJO) melalui kuesioner dan wawancara mendalam. Data sekunder berupa HIRADC dikumpulkan dari 11 departemen. Analisis data dilakukan dengan analisis statistik deskriptif dan analisis isi. Hasil PJO menunjukkan 20,9% hasil yang tidak memadai terkait dengan praktik kerja. Kuesioner efektivitas kontrol menunjukkan hasil yang memadai untuk semua 5 variabel

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dengan hasil yang sangat sesuai. Selain itu, wawancara mendalam menghasilkan temuan positif pada semua variabel dan temuan negatif untuk sistem supervisi, implementasi hierarki kontrol, dan implementasi kontrol. Secara keseluruhan, efektivitas CC di Divisi X PT A masih perlu ditingkatkan, terutama untuk aspek penegakan kontrol praktik kerja dan sikap pekerja terhadap CC.

Kata Kunci : Kontrol Kritis; Manajemen Kontrol Kritis; Efektivitas Kontrol; Observasi Pekerjaan Terencana; Praktik Kerja

INTRODUCTION

In 2018, The Occupational Health and Safety Administration (OSHA) reported that accidents occurred every week and caused losses of 1 billion dollars in medical costs, compensation to employees, and violated regulations. In 2019, the International Council Mining and Metals (ICMM) also reported that 287 workers in companies around the world experienced fatalities. In Indonesia, from 2013 – 2021, there were 428 minor accidents in mining accidents, 258 serious accidents and 195 incidents that resulted in death (ESDM, 2021).

Responding to the high number of accidents, ICMM (2015) published a Critical Control Management (CCM) framework. In Critical Control Management: Implementation, published by ICMM (2015), critical control is a control that is crucial to prevent or mitigate an incident. Critical control is also defined as control that directly prevents uncontrolled energy from causing fatalities; escalation of the consequences of an accident; and is a specific control of a task (Selleck; et al, 2022). The unavailability or failure of critical controls can increase the risk value significantly even if other controls are well-implemented. Therefore, the purpose of CCM is to identify, assess, account for, and verify the effectiveness of critical controls.

CCM explained that the risks from critical tasks can be managed better by focusing on critical controls. The purpose is to support better risk reduction (Anggito and Syaaf, 2018). There are 9 stages in Critical Control Management, namely process planning, identification of undesirable events / critical tasks, identification of controls, selection of critical controls, definition of performance and reporting, determination of accountability, implementation in specific areas, verification and reporting, and response to inadequate critical control performance. This framework was developed based on various theories, models and standards related to risk control.

In accordance with ICMM recommendations on CCM, it is necessary to know critical controls effectiveness. Control effectiveness can be described as a factor in the availability, implementation, and ability of controls to prevent and mitigate an incident (Hassal, et al, 2015). Based on the Matrix on Occupational Safety and Health Management Systems from the International Labor Organization (ILO) (2013), there are 5 elements that can be used as a reference for assessing the effectiveness of controls. These five elements are the supervisory system, implementation of the control hierarchy, implementation of controls, policy conformity, and hazards and risks compliance. The effectiveness of critical controls is influenced by human factors, such as competence, safety awareness, and ability to utilize controls (Li, et al. 2017). Meanwhile, workers' behavior is greatly influenced by supervision and risk management (Winge, et al, 2018). Therefore, the perception of supervisors as enforcers of safety in the workplace is the lens that provides the data in this research.

The effectiveness of critical controls can be assessed through their actual implementation in the workplace. This can be obtained through direct observation and historical data review. In this research, both methods were utilized through analysis of Planned Job Observation (PJO) data, HIRADC, control effectiveness questionnaires, and in-depth interviews with supervisors. In accordance with the objectives of CCM, this research will focus on the identification, assessment, accountability, and verification of the effectiveness of critical controls.

PT A is a big mining activity in Central Papua, Indonesia. Nowadays, PT A still experiences accidents in the field. In 2020, total recordable injury rate (TRIR) was 0.168 and then increased 0.176 in 2021. In addition, PT A has many divisions to support the activities, one of them is X Division. Division X, which is a part of the operation division has responsibility to ensure that all geotechnical requirement both in surface mine and underground mine in PT A have been implemented. For that, employees in Division X need to do the task in the field with critical risk. Beside it, in 2022, only 108 of 202 critical task in Division X was reviewed in the field using planned job observation (PJO), so some critical activity was still needed to be reviewed. Therefore, this research is needed to ensure that critical control in Division X has been reviewed in the field.

RESEARCH METHOD

Method is a method of work that can be used to obtain something. While the research method can be interpreted as a work procedure in the research process, both in searching for data or disclosing existing phenomena (Zulkarnaen, W., et al., 2020:229). This research is semi-quantitative research with descriptive model. The location of the data collection includes open mines and underground mines of PT. A. The data used is primary and secondary data collected in Division X PT. A from January until November 2023. Primary data was collected through questionnaires about control effectiveness and in-depth interviews with supervisors. Secondary data was collected through the results of Planned Job Observation (PJO) that is available in digital workspace (DW) PT A and Hazard Identification, Risk Assessment, and Determine Control (HIRADC) from 11 departments which are under Division X PT. A.

The total population who has responsibility to do PJO is 50 employees, and this research is using Taro Yamane Formula to calculate the sample. After the calculation, the minimum sample for survey is 16 employees.

For data collection, researcher implement some step namely:

HIRADC Collection. This document is utilized to identify critical tasks and critical control that need to be reviewed in the field by supervisor. All critical tasks and controls have been summarized and communicated to supervisors.

PJO Collection. This data is available in digital workspace in PT A, so it is easier for researchers to check each critical task one-by-one and note findings regarding PJO result.

Control Effectiveness Questionnaire. This questionnaire is released to get the supervisor's perception related the critical control. The questionnaire is created by researchers based on 5 elements in the risk management matrix from the International Labor Organization (ILO) in 2013. These elements are supervisory system, implementation of control hierarchy, implementation of controls, policy conformity, and hazards and risks compliance. Questionnaire will give 10 statements namely:

a. Supervisory system

Q1: A documented management system to supervise critical controls regularly is available.

Q2: Critical controls are always being verified before the work starts.

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b. Hierarchy control implementation

Q3: The critical controls are in conform with HIRADC.

Q4: The critical controls include engineering controls, administrative controls, work practice controls, and PPE.

c. Control implementation

Q5: The critical controls are working according to its design and function.

Q6: The workers know the availability and function of each critical control.

Q7: All workers in the area are able to access and use the critical control.

d. Policy conformity

Q8: The critical controls are in accordance with standards.

e. Compliance with hazard and risk

Q9: The critical controls are the suitable control for the existing hazards and risks in the task observed.

Q10: The critical controls are able to prevent and/or mitigate accidents.

In-depth Interview. In this research, in-depth interviews were conducted using a semi-structured method with 3 informants who met the criteria, namely supervisors who had implemented PJO in January - November. Questions asked during the interview relate to the supervisor's perception of the effectiveness of critical controls.

In addition to analyze the data, researcher conduct some activity namely:

Descriptive statistical analysis. Descriptive statistical analysis was carried out for control effectiveness questionnaire data using SPSS version 22. Next, the value for the respondent's answer to each question is calculated by multiplying the answer score by the frequency of the answer (Strongly Disagree = 1; Disagree = 2; Agree = 3; Strongly Agree = 4). Then, the average value of each question will be translated into categories based on interval scale calculation with a range of 0.75 (Very Inadequate = $1 < x \leq 1.75$; Inadequate = $1.75 < x \leq 2.5$; Adequate = $2.5 < x \leq 3.25$; Very Adequate = $3.25 < x \leq 4$).

Content analysis. Content analysis was carried out on secondary data, which was data from PJO and in-depth interviews. Content analysis was carried out using 2 methods, namely intra-informant analysis and inter-informant analysis.

RESULT AND DISCUSSION

HIRADC Result

HIRADC data collection which have been collected from 11 departments. According to Table 1., Division X in PT A had 184 critical tasks and 4951 critical controls which was dominated work practice control 48. In addition, Department K had the highest critical task and critical controls followed by Department H and E. Beside it, according to Figure (1) showed that all departments have reviewed critical task in the fiel

PJO Result

In this research, a PJO analysis has been carried out in January - November 2023. The aim of PJO analysis is to determine the effectiveness of controls based on PJO reports by supervisors. During this period, 412 PJOs were identified with 326 (79.1%) with adequate result and 86 (20.9%) with inadequate result. The following is a description of the data from the PJO analysis with notes on the findings.

Based on table 2, it showed that work practice control was the highest finding in PJO result with 62 findings (72.1%). The findings were related to Standard Operating Procedure (SOP) implementation of light vehicle operation, geotechnical inspection, working at height, manual handling, etc. In addition, administrative control is still be found in PJO with 13 findings (15.1%). In administrative control, researchers found that sign installation and socialization by company to employees are the most frequent findings. In addition, 8 findings were addresses about PPE which correlated with PPE usage consistency by employees in the field. Lastly, engineering control has the lowest findings in the field with 3 (3.5%) regarding the ground support issue in underground mine and access condition for light vehicle.

Questionnaire Result

In this research, data was collected by distributing questionnaires to supervisors in Division X PT. A. From the 50 population, 17 valid respondents were obtained. The following are the results of data analysis from the control effectiveness questionnaire.

Based on Figure (2), we can see the description of the respondents' answers to each questionnaire question. In general, respondents seem often choose the answer of “agree” or “strongly agree”. However, there were 3 questions that received inappropriate answers, namely questions with codes Q2; Q5; Q10 which represent elements of control conformity with policy; control implementation; and monitoring systems.

Based on the respondents' answers, the average value was calculated for the answers to each question using the standards determined in the research methods section as presented in Figure (3). Based on Figure (3), the average respondent's answers to 7 questions (Q1; Q2; Q3; Q4; Q5; Q6; Q10) were in the adequate category. Meanwhile, the average respondent's answers to the other 3 questions (Q7; Q8; Q9) fell into the very adequate category. So, it was concluded that majority of employees' perception towards critical control was in the adequate category, which means it was appraised as effective.

In-Depth Interview

The interview was conducted to 3 supervisors who have the responsibility to do PJO. All interviewed supervisors have conducted PJO since January – November 2023. In below, the summary of interview result.

According to the interview result above, it showed that all employees stated that all 5 categories in effectiveness assessment for critical control can be fulfilled by employees. Positive finding was dominant than negative finding in this interview. Although positive findings can be found in the PJO, the informant still gave the recommendation to improve the quality of critical control in the field.

This research was conducted to assess the effectiveness of critical control implementation based on employee's perception and observation using planned job observation, and in-depth interview. Overall, all data sources showed that employees felt that critical control effectiveness was adequate to prevent the accident.

According to HIRADC, the number of critical tasks in Division X PT A was 184 critical tasks with 4951 critical controls. Most critical controls were work practice control with total 2417 (48.8%). Regarding work practice, the Center for Diseases Control and Prevention (CDC, 2022) stated that it is a part of administrative control that is implemented to reduce the probability of risk exposure through the adaption to the way work is conducted. In Addition, OSHA (2014) stated that in general there are 2 control types, namely engineering control and work practice. Work practice control is about the concept of how employees can work safely. The example of work practice control is, but not limited to: housekeeping, personal hygiene practices, change of work area, sanitation facilities, inspection and maintenance regularly, supervision. Division X PT A also uses this term to define work practice. Some work practice in Division X PT

A is not limited to SOP implementation, LV pre-check list, work area inspection, etc. To put it simply, the definition of work practice control in Division X PT A is some controls that must be conducted by employees, meanwhile administrative control is some controls that must be implemented by the company.

WorkSafe Victoria (2022) also stated that work practice control is more possible to be implemented than engineering control, however, the effectiveness to reduce the risk is less. It is possible to be implemented by a company which has less resources and needs to create immediate control in the field. Therefore, work practice control is companies' "favorite" control to prevent accidents.

In addition, PJO implementation was completed from January until November 2023 toward 184 critical tasks which be collected from 418 PJO documents. The result showed that there were findings that needed to be improved from 86 PJOs. These findings showed that there is a probability to improve the critical control based on HIRADC. ICMM stated that the unavailability of critical control can increase the probability of major or fatal accidents. Based on the result of this research, the most frequent findings are related to SOP. According to Reason (1990) regarding Generic Error Modelling System, an error categorized as rule-based mistakes occurred by applying wrong rule for a given situation which led to a tendency to make the same wrong action over time. This can increase the accidents rate if not handled promptly on the right target. Beside it, based on the Safety-II theory, the violation of SOP is viewed as worker's attempt to manage system complexity (Dekker, et al., 2013). Hence, from both the perspective of Safety-I and Safety -II the response to this is to do behaviour-based approaches in individual and organizational level (EU-OSHA, 2022).

In accordance with the PJO analysis result, researchers found that in the in-depth interview, informants stated that worker's behaviour and compliance with work practice controls are the obstacles in critical controls implementation. This is proof that even if work practice controls are easily issued by the company, the implementation of it needs a high level of perception from workers. Various research has proved that workers hold one of the keys to successful OHS programs. Osei-Asiber, et al. (2021) have stated that accidents tend to be associated with the lack of competency, knowledge, and skills of the workers to perform safety acts in the workplace. According to Zhou and Ding (2017), workers found themselves in a position of risk either due to their ignorance or

inability to behave safely. Meanwhile, the research conducted by Hopkins (2011) result in the finding that violation of existing safety rules and procedures is one of the main leading causes of safety accidents and injuries. Other findings found from the in-depth interview is the inability to assure critical controls' reliability. Informants stated, this occurred as the outcome of the scheduled PJO system that preferably conducted by supervisors. So it is hard to observe the actual condition. PJO seems to be conducted only for the interest in meeting the supervisor's targets that the two-way communication is easily missed. This also strengthen by the questionnaire result which showed some respondents gave the score 2 (unsuitable) for questions regarding control's reliability and worker's competency. Based on literatures, there are some reasons of this occurrence. According to Ibanez and Toffel (2019), there are strong evidence that inspectors' evaluations are affected by their experience at the prior inspection and their daily schedule. The prior inspection conducted can affect the probability of negative findings increasing for the next inspection. Otherwise, the daily schedule is likely decreasing the negative findings. In The Directorate of Construction Occupational Safety and Health Administration U.S. Department of Labor Report 1999, it is also found that programmed inspections find more employees "in compliance" result than unprogrammed inspections. Which later explained the reason of the employers' favoritism towards programmed inspections is because in a scheduled scenario the observed employee would often "have gotten the message". Hence, scheduled PJO is probably not the best way to verify critical controls reliability if it is not conducted in align with unscheduled PJO, other security and assessment. As response to these findings, our informants stated that in Division X PT. A, critical control awareness training and promotion have been on going till today.

Therefore, based on the findings and discussions above, researchers concluded that the most frequent findings detected is related to worker's attitude towards work practice controls compliance. Indeed, there are factors affecting worker's attitude towards work practice controls. The research by Jenifer and Anandan (2023) explained that worker's attitude towards safety is affected by his/her experience. So it can be argued that the observed culture, wether it is good or bad, will influence the good or bad of worker's attitude. In the other hand, Rhaffor, et al. (2014) stated that to create a positive attitude in an organization require the involvement of all parties to build strong

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OHS culture. According to the illustration from the Employee Work Passion Appraisal (EWPA) model prepared by Zigarmi, et al. (2019), workers' attitudes are influenced by their personal assessments which are influenced internally by personal characteristics and externally by organizational, job, and relationship characteristics. In this study, researchers found the effectiveness of critical control in Division X PT. A is considered adequate even though several findings can be improved. However, researchers have not been able to find the root cause of the problem from these findings. So it is necessary to carry out further research to find out the problems that must be solved to obtain better control effectiveness.

CONCLUSION

Based on results and discussion, it concluded that the effectiveness of critical control in Division X PT. A still needs to be improved. According to the analysis issues related to personnel attitudes towards critical controls are the most frequently occurring items. The results of the PJO analysis show that negative findings are identified, especially in work practice controls. The control effectiveness questionnaire analysis indicated that supervisors assess critical controls as effective. Meanwhile, the interview result pointed out obstacles related to supervisory system and critical controls implementation, even though the other elements were considered adequate.

Therefore, researchers recommend that further research regarding root causes of the problems of negative findings associated with personnel attitudes towards critical controls is necessary. It is supportive to do analysis based on variables such as monitoring system, implementation of critical controls, safety culture, and other personal perception. As for responding to the problems found in this research, researchers suggest Division X PT. A to conduct regular reviews of HIRADC and PJO guidelines, provides training related to the importance of critical control for all employees, provides PJO good practice training, balances the proportion of scheduled PJO with unscheduled PJO, and builds better safety culture. Researchers are looking forward for the improvement critical controls effectiveness to optimize OHS in Division X PT. A.

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Table 1. Distribution Number of Critical Task and Control

Department	Critical Task	Critical Control				Total Critical Control
		Engineering	Administrative	Work Practice	PPE	
B	9	35	43	50	8	136
C	14	71	81	143	14	308
D	3	30	34	37	4	105
E	23	129	182	307	33	651
F	12	40	64	201	12	317
G	22	106	158	348	21	633
H	17	115	91	560	15	781
I	4	32	49	109	3	193
J	23	102	193	157	24	476
K	16	101	203	161	19	484

TABLE AND GRAFIC

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L	41	173	303	345	46	867
Total	184	934	1401	2417	199	4951
%		18.9%	28.3%	48.8%	4%	100%

Table 2. Proportion of Number of finding in PJO

	Findings			
	Engineering	Administrative	Work Practice	PPE
Total	3	13	62	8
%	3.5%	15.1%	72.1%	9.3%

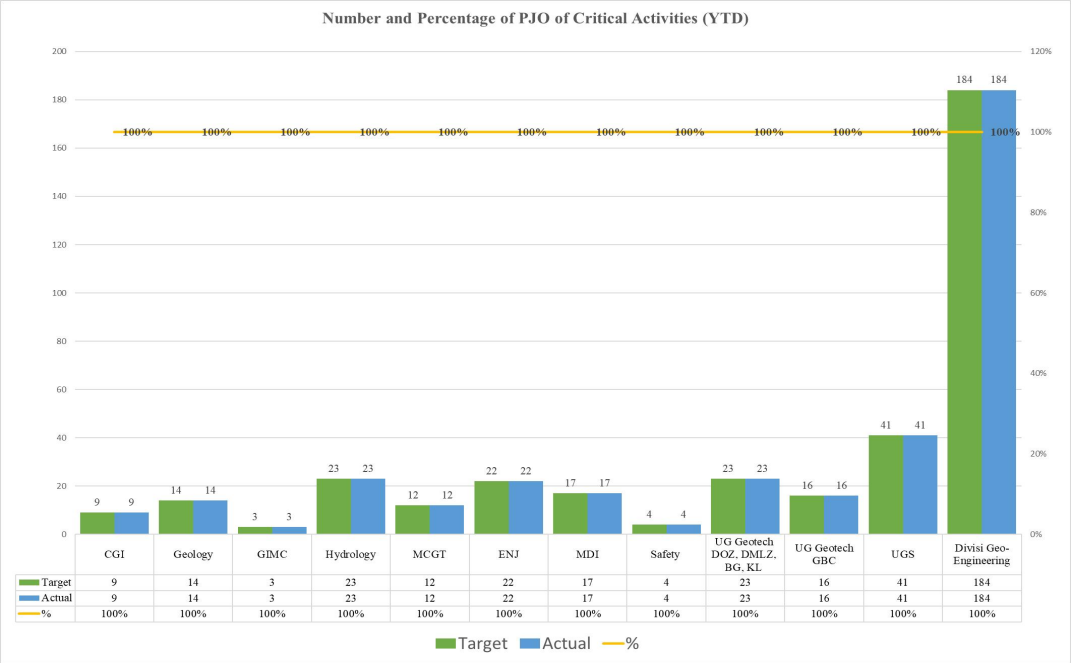
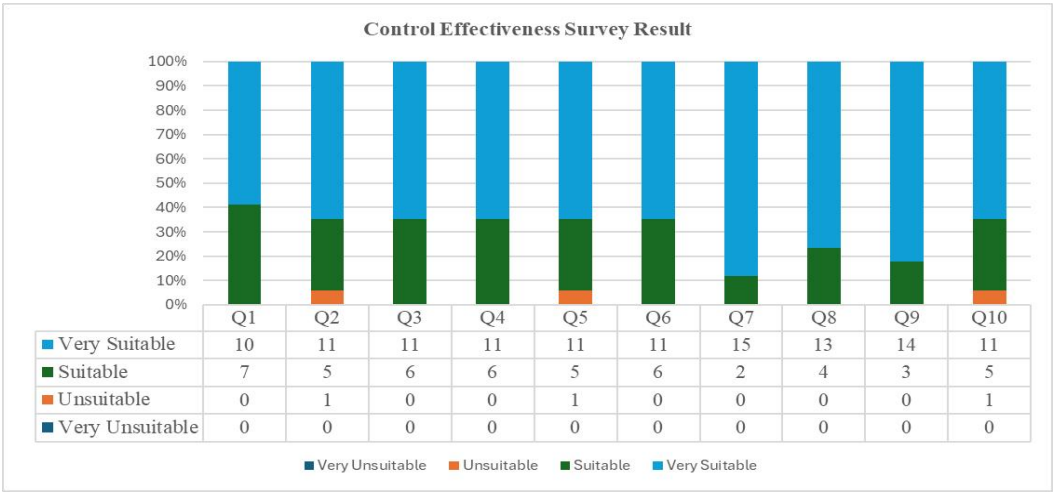


Figure 1. Number of PJO in Each Department



	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Very Suitable	10	11	11	11	11	11	15	13	14	11
Suitable	7	5	6	6	5	6	2	4	3	5
Unsuitable	0	1	0	0	1	0	0	0	0	1
Very Unsuitable	0	0	0	0	0	0	0	0	0	0

Figure 2. Control Effectiveness Survey Result

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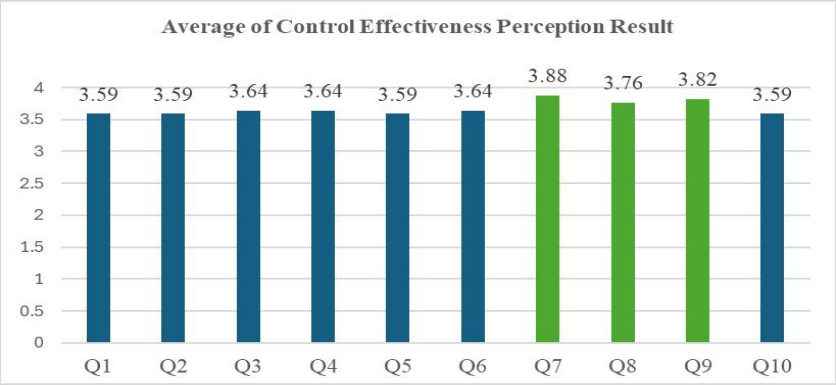

Figure 3. Average of Control Effectiveness Perception Result

Table 3. In-Depth Interview Summary Result

Element	Positive Finding	Negative Finding
Supervisory System	a. Supervisory implementation was conducted through PJO regularly b. Specific supervisory to critical control implementation is being implemented regularly c. Every finding can be reported to take corrective action	a. It was challenging to create two-way communication in supervisory action b. It was difficult to implement actual supervisory action cause of scheduled PJO system
Hierarchy Control Implementation	a. Critical control is being implemented based on hierarchy control in HIRADC	a. There is some critical control which were informed in HIRADC that being missed to observed
Control Implementation	a. The implemented critical control is functioning well	a. Employee's awareness toward critical control is still needed to be improved
Policy Conformity	a. The implemented critical control complied to standards.	No Issue
Compliance to Control Hazard and Risk	a. The implemented critical control is appropriate to prevent the existing hazard and risk in the field.	No Issue