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PROPOSED KNOWLEDGE MANAGEMENT STRATEGY BY LEVERAGING CURRENT TECHNOLOGY TO INCREASE PRODUCTIVITY OPERATION IN PT. TRIMATA BENUA

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Abstract

As coal industries is still attractive in the world, and a significant contributor for energy production which account approximately 37% for electricity generation. This type of fossil fuel is still being used by many countries despite it negative side effect to environment for example a greenhouse gas emission. Coal attractiveness is due to the fact that it is cheaper compared to other fossil fuel, resulting coal industries is still growing and predicted for many years to come. In Asia Pacific there are many countries dubbed as largest producers of coal, with China, India, and Indonesia being on the top three countries in Asia Pacific. With expected growth of 3.5% on yearly basis this makes Asia Pacific a significant contributor of the worlds coal industry. With that as well Asia Pacific contributes around 52% of the worlds carbon emissions in year 2020. Indonesia as the third largest coal producers, have approximately 8.9% growth in 2021. With projected coal production of 2.6% Year on Year. PT. Trimata Benua is one of the key players in Indonesia's coal production. However, the company experience lack of productivity in operations, causing their production target missed. Is the absence of knowledge management system in the company causing that issue to arise. With that the company need to roll out and plan effective and structured knowledge management system to address their business issue. This research is based on three research questions. First one what is the best fit knowledge management strategy, second is to identify issues in operations, and the last one is to have suggestion for the company on the implementation plan based on their needs. This research will answer those research questions by referencing to the knowledge management theories on the People, Process, and Technology (PPT) as well as adopting Nonaka's SECI model in knowledge transformation cycle and Jann model knowledge management framework (Jann). Since this research is the first stage of implementing knowledge management system, it will be a qualitative method used with data collection gathered through interviews. Data will be analyse using thematic analysis. There are several issues identified in relation of People, Process, and Technology. Ranging of the lack of professionalism, incomplete SOP, awareness and training program, and the minimum technology that is supporting operation team causing the inability of easy access to knowledge. By applying and utilize PPT, SECI, and as well as Jann framework, author manage to compile and design knowledge management system that is best fit for the company. Identifying the challenges, addressing capability gaps on the organization as well as identification of organization critical knowledge to achieve the objectives of implementation. This will be compiled into a plan in designing knowledge management system. With the implementation of the system, it will result enhancement for operation team to increase their productivity, enhance decision-making process that will benefit the company in the future and raised their

competitiveness with their competitors. The implementation plan will begin in February 2024, and it will cover three enablers of KM people, process, and technology. Strengthen the implementation the organization will also create KM steering committee that will oversee, review, and manages the initiatives. The committee will also do the evaluation on the system in making sure that it is stay updated, measuring the impact, and identify necessary changes.

Keywords: *Knowledge Management, PPT, Jann Model, SECI Model, operation effectiveness and efficiency*

Introduction

The most major source of energy for producing electricity is coal, a fossil fuel that is also used to produce steel and cement (Nidheesh & Kumar, 2019). The fact that coal is the most damaging energy source due to its high carbon content, however, is a drawback of the fuel (Nicoletti, Arcuri, Nicoletti, & Bruno, 2015). Natural gas is a less polluting but much more expensive and subject to price swings on the global market than other essential energy sources (Al-Maamary, Kazem, & Chaichan, 2017). Hence, coal has become more and more important to the world's industries.

The global coal industry has been a significant contributor to the world energy production for many years, accounting for approximately 37% of the world's electricity generation. Coal for many centuries has been an energy source of the world, and it continues to be used by many countries worldwide (Pudasainee, Kurian, & Gupta, 2020). Environmental impact has always been a concern on this industry as it is view as one of the contributors in the environmental damage (Hocquette et al., 2015). Despite that fact, coal remains a vital energy for many countries, particularly in Asia where this form of energy is abundant and relatively cheap compared to other source of energy (Shahsavari & Akbari, 2018). As stated, challenges with the industry remain visible in recent years as well. Due to the greenhouse gas emissions and growing competitiveness of alternative energy sources like natural gas and renewables (Mac Kinnon, Brouwer, & Samuelsen, 2018).

Overview of the global coal industry, including its production, consumption, and the challenges it faces particularly in Asia Pacific Region with China currently the largest producer of coal globally, producing about 3.84 billion metric tons in 2020 according to the International Energy Agency (IEA). And there's other country that is include in the major coal producing range from United States, India, Australia, and Indonesia (Fragkos et al., 2021).

Country	2020[1]	2019[1]	2018[1]	2017[2]	2016[3]	2015[4]	2014[5]
China	3,902.0	3,846.3	3,697.7	3,523.2	3,411.0	3,747.0	3,874.0
India	756.5	753.9	760.4	716.0	692.4	677.5	648.1
Indonesia	562.5	616.1	557.8	461.0	434.0	392.0	458.0
United States	484.7	640.8	686.0	702.3	660.6	812.8	906.9
Australia	476.7	504.1	502.0	481.3	492.8	484.5	503.2
Russia	399.8	440.9	441.6	411.2	385.4	373.3	357.6
South Africa	248.3	258.4	250.0	252.3	251.2	252.1	260.5
Kazakhstan	113.2	115.0	118.5	111.1	102.4	106.5	108.7
Germany	107.4	131.3	168.8	175.1	176.1	183.3	185.8
Poland	100.7	112.4	122.4	127.1	131.1	135.5	137.1
Turkey	70.8	87.1	83.9	99.8	70.6	58.4	65.2

*Figure **Error! No text of specified style in document.** Coal Producing Countries (Source: British Petroleum ~~Wikipedia~~)*

Asia Pacific region is a significant contributor to the global coal industry, for both consumption and production (Wu & Chen, 2018). As above mentioned, that China is currently the largest producer and consumer of coal in is Pacific region. According to the IEA, coal consumption in the region of Asia Pacific expected to grow by 3.5% on yearly basis until the year of 2024, it is merely driven by demand from two countries which is China and India. Other countries in the region such as Australia and Indonesia also marked as significant coal producer countries. Asia Pacific region also known for is world's largest coal-fired power plants, with countries such as China and India are relying on coal fired power generation to meet the demand for energy for its people. Asia Pacific region accounted for 52% of the worlds global carbon emissions in the year of 2020 (IEA, 2022).

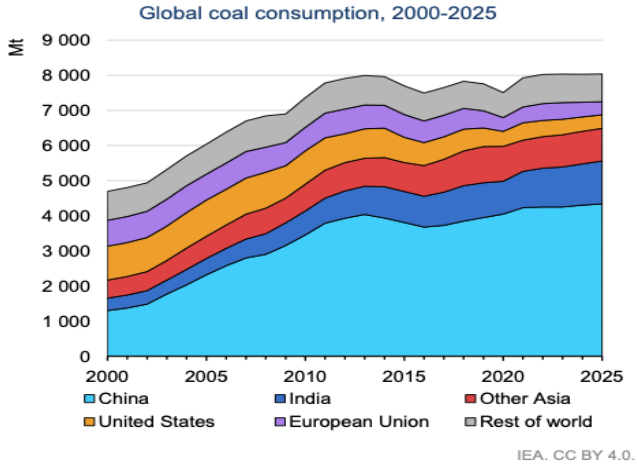

Figure 2 Global Coal Consumption (Source: IEA, 2022)

Despite all those data, Asia Pacific region is set to increased it focus on reducing its dependence on coal and transitioning towards cleaner and more sustainable energy sources. Countries like China, Jalan and South Korea have set ambitious targets for renewable energy deployment and fully committed to achieve carbon neutral by 2060, 2050 and 2050, respectively. Additionally, countries in Asia Pacific region investing heavily in carbon capture and storage technology, which eventually help to reduce emissions from coal-fired power plants.

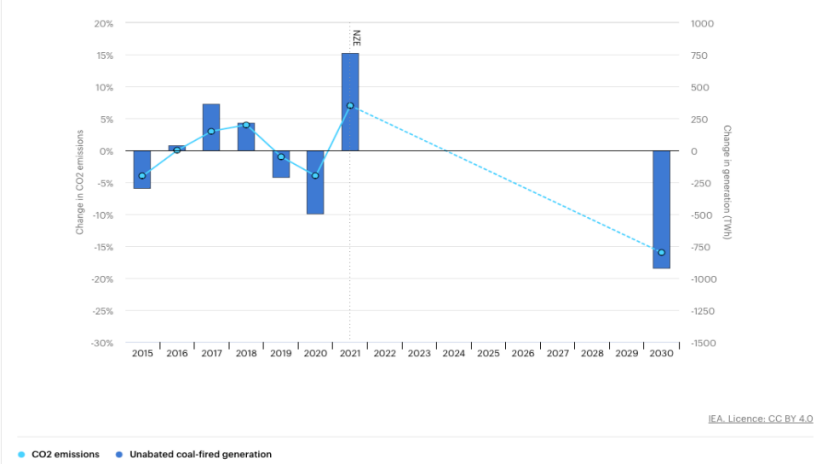

Figure 2 Annual Change in CO2 Emmissions (Source: IEA, 2022)

Indonesia crowned as the world third largest coal producers, after China and India. With as strong register growth in 2021 of 8.9%. With the projected coal mine production, a 2.6% Year on Year (YOY) growth, reaching 629.9 Mt in 2022. According to the most recent BP Statistical Review of World Energy, Indonesia is now ranked ninth in terms of the total proven world coal reserves and holds about 2.2 percent of those reserves. Approximately 60% of Indonesia's total coal reserves are made up of the less expensive, lower-quality sub-bituminous coal, which has fewer than 6100 calories per gram.

In the islands of Sumatra, Java, Kalimantan, Sulawesi, and Papua, there are numerous smaller pockets of coal reserves, but the three biggest locations of Indonesian coal resources are: South Sumatra, South Kalimantan, and East Kalimantan. With only a few large producers and numerous small companies who hold coal mines and coal mine concessions, the Indonesian coal sector is very fragmented (mainly in Sumatra and Kalimantan). It is estimates that around 70-80 percent of coal production will be exported to foreign countries, and the rest will be sold to local market.

As the war in Ukraine escalated, resulting European Union restriction in importing new coal from Russia that give benefit for coal producing countries like Indonesia as the European countries will seek other source of coal one of them is from Indonesia. And in 2022, Indonesia government increase the target of coal output to 663 Mt in 2022 (Wollff, 2023).

With government increased their target output of coal, major coal company in Indonesia also raised their target (Maulidia, Dargusch, Ashworth, & Ardiansyah, 2019). Adaro Energy plan in 2022 will expand their output to 56-60Mt, while PT. Bumi Resources plan to produce 83-89Mt in 2022 compared to 78.8Mt in 2021. Indonesia's coal production is anticipated to increase by barely 0.2% over the projected period (2022-2026) to reach 635.5Mt. The Anggana (2023), Tunas Inti Abadi (2024), Bunyu (2025), and PT Samantaka Batubara and PT Karya Usaha Pertiwi projects that will both close in 2026 will have an influence on production.

The production of coal in Indonesia attained 294.4Mt, or 44.4%, of the target up until June 28, 2022, according to the Ministry of Energy and Mineral Resources.

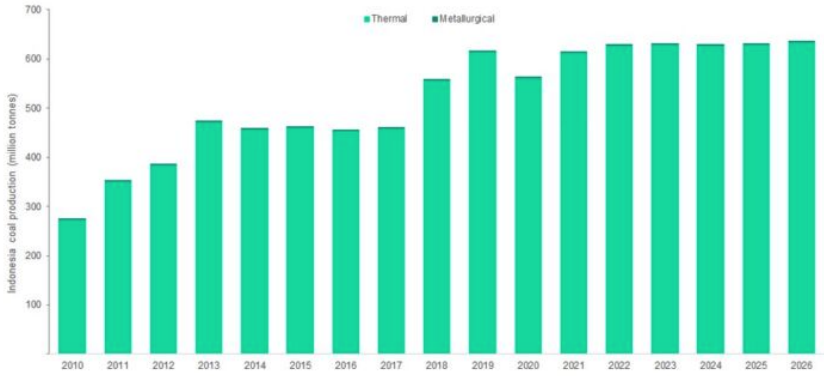

Figure 3 Indonesia Coal Production (Source: MiningTechnology.Com)

PT. Trimata Benua has been one of the key players in Indonesia coal industry. Contending with some of Indonesia's prominent coal company such as Adaro Energy, PT Bumi Resources and others. To stay competitive with other company in the industry they are supported with a numbers of affiliates companies ranging from mining contractor, logistics, shipping, and marketeer. They have structured they operation in such a way to streamline their services from up streamed to down streamed, therefore effectiveness of the operation will be achieved.

Operation of the company located in Banyuasin South Sumatra where their head office located in Jakarta. PT. Trimata Benua objectives is to increase the quality of their human resources, the company emphasized in hiring from local talent especially for their mine site in South Sumatra. To make sure that their presence in the area will be beneficial for the local communities and increase their surrounding area economic value (Pirard, Petit, & Baral, 2017).

Method

This final project will employ a methodology that is based on action research. Action research as defined by O'Leary (O'Leary, 2004) "research strategies that tackle real problems in participatory, collaborative, and cyclical ways in order to produce both knowledge and action". From that statement, the methodology will revolve around change that is both social and professional. As it will have the orientation of its goals to have change, not just a knowledge gathering alone. Action research studies usually based on everyday issues, and solely depending on how to create a solution to those issues, a practical one.

a) Elements of action research include:
b) Problem identification
c) Researching problems and it causes
d) Developing response to the problem
e) Implement proposed solution.
f) Implementation observation
g) Reflection on the results

Action research also a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices and the situations in which these practices are carried out (Carr & Kemmis, 1989).

According to Thomas Gilmore, (Gilmore, Kranz, & Ramirez, 1986) "action research...aims to contribute both to the practical concerns of people in an immediate problematic situation and to further the goals of social science at the same time." Thus, there is a dual commitment in action research to study a system while also collaborating with system members to change it in what is regarded as a desirable direction. This dual goal necessitates the active collaboration of researcher and client, emphasizing the importance of co-learning as a primary aspect of the research process."

The two most commonly associated data collection methods with action research are observation and interviews. Though other methods, such as questionnaires, tests, or documentary evidence, can also be used (Scanlon, 2000).

Research Design

For this thesis, we began by identifying the problem on the company and layed out the factors that is contributing into the business issue experienced by the company. After business problem identified then the research objectives can be set. Literature review on items that will be relate with this study and its objectives will be conducted as well. From its component, process, readiness, and implementation. Those reviews from literatures will be the guide in point on how to conduct this study and step by step process to get the objectives for this research. This final project will use qualitative research, as this is an early stages of knowledge management initiatives, when experience level is generally low (Becerra-Fernandez & al, 2004). Data collection in this research will be limited within the operation site team supervisor and manager and head office operation manager to assess the readiness of the knowledge management. The result will then become a baseline to provide recommendation and conclusion and to answer the research question which is the knowledge management strategy that is best for the organization.

Results and Discussion

In this chapter, the author will explain and analyse the current situation in the company and, consequently, will propose efforts and plans to implement knowledge management strategy solutions for the company that will be based on the research objectives, which is to have an increase in productivity of operation team (Córdova, Durán, & Galindo, 2015).

Data is gathered through interviews with members of the operation team and those associated with the operation team in the head office and site office. Which is built on a foundation of culture, organisation structure, and IT support (Alves & Alves, 2015).

All data was gathered through interviews with members of the operations team, IT, and HR. The author will discuss and clarify the current position in the organisation, focusing on the operations team's everyday actions (Baumgartner & Rauter, 2017). This will aid in providing a solution for the team to ensure an efficient and effective functioning.

Codification from the interview will be compile into one table, and we can see in appendix. It will be colour coded to identify the condition from each of the respondents from the people, process, and IT or technology point of view (Bower & Sturman, 2015).

We can take summary from the interview itself and code each of the statement to find the similar theme on the interview that will give the point of view into what is the

real problem facing by the operation team ranging from its people and support functions.

As the qualitative approach selected for this research and interview used as tools to be gained data (Alamri, 2019). The code and theme of the interviews will be described in the table below; with these code and theme, we may get a sense of the state of the operating team and its surroundings, as well as their obstacles.

Figure 4. Code from Interviews (Source: Author)

From those code, summarize from the interview we are now working on the themes and the highlights from each of the code to find the root of cause of what is happening in operation team, and their challenges in order to increase productivity. Below table will further explain.

Theme	Coding	Type
Training and Development	Employee Development	Sub Cause
	Lack of soft skill and fundamental skill	Root Cause
	Absence of employee training policy	Root Cause
	Regulatory compliance and training	Sub Cause
	Lack of employee professionalism	Root Cause
	Employee development	Sub Cause
	Training and development for operations	Sub Cause
Reward system and Compesation	Employee recognition	Sub Cause
SOP Implementation and Structuring	Lack adherance of SOP	Root Cause
	SOP and knowledge dissemination	Sub Cause
	Established policies and SOP still not covered all operation process	Root Cause
	Lack of coordination and cross function between operation and other departments	Root Cause
	Decision making and authority	Sub Cause
	Lack of sharing activities and shared best practices	Root Cause
IT Infrastructure and Communication	No centralized access for SOP and other knowledge resources	Root Cause
	Communication and infrastructure	Sub Cause
	SOP accessibility and implementation	Sub Cause
	Remote locations of mining fields	Root Cause
	Inadequate communication infrastructure	Root Cause
	Limited option of technology due to the locations of the office site and mining fields	Root Cause
	Support challenges due to locations	Root Cause
	Data management and sharing	Sub Cause

Further analyses are to group each of the root causes into three knowledge management enablers based on those root causes. This provides a clear view of the causes affecting each of the knowledge management enablers.

The table below summarises each root cause or business challenge depending on each enabler.

Table 1. Business Issue Summary

Business Objective	Enabler Aspect	Business Issue
Increase Productivity	People	Lack of employee professionalism
		Lack of soft skills, and also other fundamental technical skill that is related in operation process
		The adherence of employee in doing their daily work based on established SOP that the company have issued.
		Lack of coordination between operation team with other department for cross function support
	Process	Absence of establish policies for employee trainings.
		No centralized access for SOP and other knowledge resources
		Established SOP and policies that is not covered all operation process
		Lack of sharing activities, and share best practices
	Information Technology	Remote location of the mining field
		Limited options of technology due to the location of the site office and mining fields
		Inadequate communication infrastructure
		Support challenges due to location.

We may summarise those business issue in the figures below, which depict the three components of knowledge management. To better visualization we utilize the fishbone diagram to have a better look of each of the enabler problem or issue.

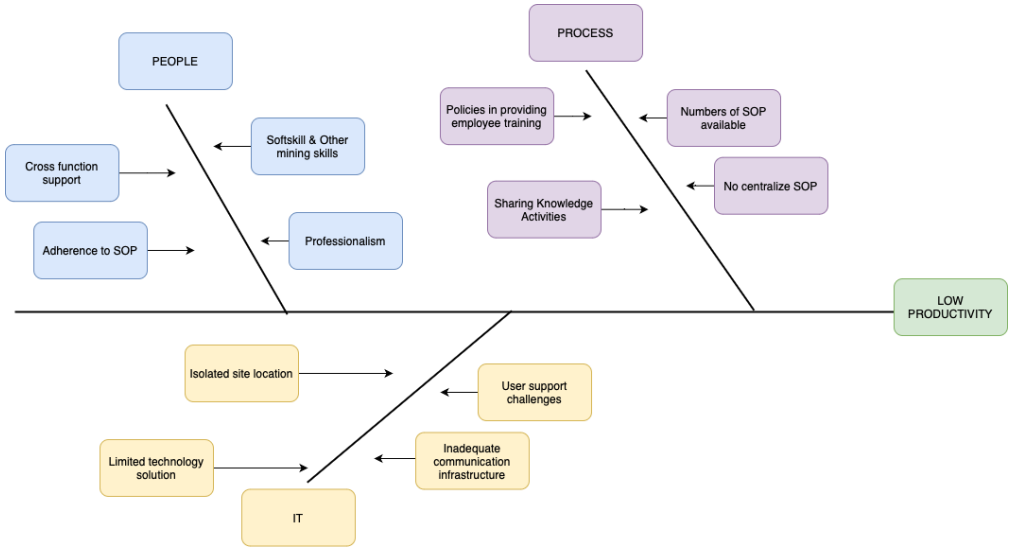

Figure 5. Root Cause Analysis

With above diagram, explanation of each component of people, process, and technology will follow as per below explanation.

People

We can see in the figure 4.2 above, that there is an issue currently in the people components. The first one is there's a need to really enhance communication and collaboration within functions that is related to operation team be it from HSE department, HR, and IT. Since there is still unwritten formal SOP currently established cross function communication is still lacking, with sometime resulting ineffective operation.

The second is the soft skills and other mining skills of the employees within the operation team; personnel with a different attitude towards work operation, particularly on-site mining employees, may struggle to communicate clearly and effectively with the head office operation team. This is compounded by the absence of current SOPs that control the operation process (Davidson et al., 2014).

The third characteristic is their professionalism. According to HR, a large number of on-site mining personnel operated in an unprofessional manner, which was caused by a lack of understanding and ethical behaviour, which harmed their performance and also the company.

The fourth characteristic is their adherence to the established SOP. Cases have arisen where lack of adherence to existing SOPs has resulted in events that hinder the operation process from being effective based on the aim established for the operation team by management (Leveson, 2015).

Process

On this component, the first one is the number of existing SOP is still inadequate to cover process in the operation team. Currently, SOP will only govern a few processes involving operation team. And if should operation team face by one problem and there is no SOP available to tackle that it will affect the timeline for operation team to complete tasks.

The second one is the SOP is not yet centralized and can be access easily by employees. With the challenges of their communication infrastructure on mining field this will also create problems if operation team need to contact head office or site office to get advice on how to solve the problem arise.

The third is absence of plan on employee training, as the relation with the layout issue in people section that employees especially in mining field that their lack of soft skill and other mining skills that causing problem in the process as well. As today, training given to operation on-site mining field just to comply with government regulation which is POP (Pengawas Operasi Pratama) and POM (Pengawas Operasi Madya).

The last one on this component was that the sharing activities that involve employees from operation team and with head office team. The absence of this process causing the company to experience slower decision-making process. Thus, the domino effects will be lack of innovation from the company, work quality will be stale, and production process will be slower.

Information Technology

The challenges with information technology for the company is that in its infrastructure. Current infrastructure provides the basic needs for the operation such as email, one server in company on-site mining office and solely dependent with the use of third-party applications.

In order to support users especially operation team, IT will have difficulties in reaching out to the user. Causing that sometime urgent matters that operation team facing will be address quite some time affecting operation timeline.

That challenge is the effect of various limitation that the company facing in terms of technology.

The first is the limited technology solution options for the on-site mining field due to its location on the outskirts of a major city in the area.

The second issue is the 12-kilometer distance between the on-site headquarters and the mining area, which made it difficult to communicate with the operating crew in real time.

Because the mining field is fairly secluded, there is limited access to technology such as the internet, and energy or electricity is still insufficient to support the activity. They rely on radio solutions, which have their own set of issues in enabling real-time communication between the mining field and the site office and head office.

4.1.4 Analysis on Organisational Readiness for KM

With the help of data and previous explanations, the organization's readiness to adopt knowledge management will be explained in terms of culture, structure, and IT or information technology support. Analysing each of the aspects that will support the knowledge management system will provide a clear image of what needs to be addressed, and the solution will align with the company's objectives.

4.1.4.1 Organization Readiness in Culture

In this section the culture itself consists of trust, collaboration, and learning.

On trust, there are couple points that operation team have shared.

- Operation management team trusted their worker to able perform their work on day-to-day basis. However, monitoring is still needed in making sure that the work carries out perfectly.

- Control needed to supervise and advise worker if should there's an issue in their work.
- Capabilities and knowledge within the key person are sufficient in terms of their technical skill and hard skill.
- Professionalism aspect that still need to be improve.
- There is still no adequate process for induction in terms of new employee.
- Check and balances on employees.

On collaboration, have been informed as well by operation team as below points.

- Need to have more cross-function support and communication process that is standardize in order for the process to flow perfectly.
- There is a formal morning meeting what is called P5M (pertemuan 5 menit) to discuss on how work will be on that day.

For learning part, operation team also shared what is currently the situation in the company.

- Training that is mandatory received by operation team is to comply with government regulation, which is *POP (pengawas operasi pratama) and POM (pengawas operasi madya).*
- Most operation team have the awareness of what is knowledge management system and its benefit for themselves and the company. And from the data it showed that eagerness of the team to implement knowledge management system.
- Operation team shared that they are looking forward to having other related with their work training, such as soft skill and others.
- Learning still not one the items in their KPI, causing lack of buy in for learning in operation team.

HR will do an assessment of mapping trainings that for employees, for other than mandatory trainings that will improve employee performance.

Organization Readiness in Structure

This section will discuss on the organization readiness of their centralization, formalization, and reward systems.

On centralization, operation team have shared these points that is current conditions in the company.

- For operation needs, on-site team has the ability make judgement and to take decision locally.
- The decision that is involving regulatory compliance, financial support or penalty and if involving health and safety. On-site team will contact head office for the decision and support.

On the formalization aspect surrounding the operation team, there are a couple of points.

- SOP established in the company. However, the number of SOP and policies currently available is still not adequate for operation team.
- Familiarization and awareness program for operation team on existing standard operating procedures is still not establish.
- SOP created only if the company feel the need to create one based on the result of events.

- Most SOP and policies are not yet centralized. Some of the operation team know where to find, for many of the rest usually will ask to head office and it will be sent via email to the employee.
- There still no learning from past experience and documentation of that experience.
- Head of operation, managers from other department as well will be the right position to be the contributor to knowledge management system.

For reward systems. Operation team has also shared the current condition in the company and their views toward the program.

- Currently no reward system available in the company.
- The compensation and benefit of the operation team is still not sufficient and still below the market range.

Organization Readiness in IT Infrastructure

On this section there are a numerous information that give a picture of what technology supported the operation.

- Basic technology provided to operation team such as email, laptops, and server.
- On-site server act as data sharing only, and not online nor easily accessible.
- Depending on third party application to keep the information flowing.
- Use of radio solutions that have its limitation.
- Future project is to setup internet connection on the mining fields and to create application that will help to increase the information flow to be real time.

By examining the findings based on the interviews with stakeholders and interview coding. Based on the information obtained, we can create a summary of the root of cause based on each enabler. This will serve as the foundation for the author to propose a strategy that is appropriate for the company, particularly the operations team, in order to align with the research questions, which are to have the operations team to increase productivity, thus aligning with the company goals is to maximise efficiency and deliver excellence, with collaboration at its core. With that explanation the summary points and challenges will be explain in below table with all the list on each of enabler aspect. These will be explained one by one based on the enabler aspect of people, process, and technology.

Business Objective	Enabler Aspect	Issues
Level up employee knowledge to Increase Productivity	People	Lack of employee professionalism
		Lack of soft skills, and also other fundamental technical skill that is related in operation process
		The adherence of employee in doing their daily work based on established SOP that the company have issued.
		Lack of coordination between operation team with other department for cross function support
	Process	Absence of establish policies for employee trainings.
		No centralized access for SOP and other knowledge resources
		Established SOP and policies that is not covered all operation process
		Lack of sharing activities, and share best practices
	Information Technology	Remote location of the mining field
		Limited options of technology due to the location of the site office and mining fields
		Inadequate communication infrastructure
		Suppport challenges due to location.

a. Business Solution

Following the completion of the above analysis, the next step is to identify the business strategy to overcome that list of issues and its indicators of success. And what is require for the operation team in order to pursue the company goal of maximising productivity and delivering excellence while supported by collaboration. These efforts will be a driving force in improving the operation team's operations and expertise, resulting in increased productivity in the operation team.

Tabl 2 Business Strategy, Objectives, Business Issues Analysis

Business Objective	Business Issue	Business Strategy
Increase Productivity	Lack of employee professionalism	Focus on employee development to become more professional
	Lack of soft skills, and also other fundamental technical skill that is related in operation process	Increasing knowledge on fundamental skill for mining and soft skill
	The adherence of employee in doing their daily work based on established SOP that the company have issued.	Change of behaviour of employee to follow established SOP
	Lack of coordination between operation team with other department for cross function support	Cross function support strategy
	Absence of establish policies for employee trainings.	Establishing policies for employee trainings
	No centralized access for SOP and other knowledge resources	Centralizing access for SOP and working knowledge
	Established SOP and policies that is not covered all operation process	Complete set of standard operating procedure
	Lack of sharing activities, and share best practices	Promoting culture of learning, sharing, documenting, and storing knowledge
	Remote location of the mining field	IT & Communication infrastructure Refresh
	Limited options of technology due to the location of the site office and mining fields	IT & Communication infrastructure Refresh
	Inadequate communication infrastructure	IT & Communication infrastructure Refresh
	Support challenges due to location.	IT & Communication infrastructure Refresh

Business Objective	Business Issue	Business Strategy	Indicators
Level up operation	The adherence of employee in doing their daily work based on established SOP that the company have issued.	Working based on established standard operating procedure	Employee following the standard operating procedure and minimize issues that will affect performance
	Established SOP and policies that is not covered operation process	Working based on established standard operating procedure	
	Limited options of technology due to the location of the site office and mining fields	IT & communication infrastructure Investment	Operation team have access to established SOP from any locations
	Inadequate communication infrastructure	IT & communication infrastructure Investment	
	Suppport challenges due to location.	IT & communication infrastructure Investment	
	Remote location of the mining field	IT & communication infrastructure Investment	
	No centralized access for SOP and other knowledge resources	IT & communication infrastructure Investment	
employee knowledge to Increase Productivity	Lack of soft skills, and also other fundamental technical skill that is related in operation process	Increasing knowledge on fundamental skill for mining and soft skill	Operation team will be able to have solutions for operations issue
	absence of establish policies for employee trainings.	Increasing knowledge on fundamental skill for mining and soft skill	Operation team will be able to decrease incidents that will cause operation delay
		Increasing knowledge on fundamental skill for mining and soft skill	Operation team will be able to meet deadline and target of production
	Lack of employee professionalism	Focus on employee development to become more professional and becoming knowledge worker	Measurement of employee performance and impact on trainings received
	Lack of sharing activities, and share best practices	Promoting culture of learning, sharing, documenting, and storing	Innovation, best practices are growing from operation team support increase of collaboration
	Lack of coordination between operation team with other department for cross function support	Promoting culture of learning, sharing, documenting, and storing knowledge	

Table 3. Organization Capability Gap Analysis

Business Strategy	Organization Capabilities	Expected Capabilities	Gap
Focus on employee development to become more professional	No process yet to measure employee performance	Absence of performance indicator as measurement of employee performance	Performance indicators for operation employees
Increasing knowledge on fundamental skill for mining and soft skill	Limited knowledge for operation team in order to perform their work	Operation employee equipped with required skill and knowledge to perform their work	Limited knowledge and working process in operation team
Change of behaviour of employee to follow established SOP	adherence of employee to follow SOP is minimum	operation employees will adhere and follow to work based on the SOP established	operation team understand, adhere all existing SOP and policies in doing their work
Cross function support strategy	P5M (pertemuan 5 menit) activity	Cross function support with structured community of practice that support knowledge worker	Absence of structured community of practice
Establishing policies for employee trainings	Minimum employee skill, operation process is not maximized due to lack of trainings	operation employee that trained and have adequate skill to perform their work and achieve target objectives of the company	comprehensive training policy that govern trainings to improve skills for operation employee for understanding on working with safety, best pratices, analyse working condition, also monitoring process in production target achievement
Centralizing access for SOP and working knowledge	No online repository server	online repository that is accessible from all locations	central server, folder repository and commmunication infrastructure covering all location
Complete set of standard operating procedure	SOP established is minimum	SOP that surround operation team will be maximum	Fulfilment number of SOP that is established
Promoting culture of learning, sharing, documenting, and storing knowledge	P5M (pertemuan 5 menit) activity	Community of practice that support knowledge worker	Improved of sharing activity in learning from experience, applying best practices, sharing knowledge to support innovation
IT & Communication infrastructure Refresh	Current IT infrastructure is limiting employees to have access to SOP from any location	IT infrastructure will be accessible from all locations	Accessibility towards getting information is limited
IT & Communication infrastructure Refresh	only office site covered with internet connection	All location will be covered with internet connection	internet connection in mining field
IT & Communication infrastructure Refresh	communication delay between office site and mining field	real-time communication between all sites	establishing real - time communication connection between sites
IT & Communication infrastructure Refresh	no real-time support	real-time support established	setup of real-time communication infrastructure to improve support

Indicators	Organization Capabilities	Expected Capabilities	Gap
Employee following the standard operating procedure and minimize issues that will affect performance	a very few of the employee aware regarding the company SOP	operation employees will follow and work based on the SOP establsihed	operation team understand, adhere all existing SOP and policies in doing their work
Operation team have access to established SOP from any locations	Current IT infrastructure is limiting employees to have access to SOP from any location	IT infrastructure will be accessible from all locations	central server, folder repository and commmunication infrastructure covering all location
Operation team will be able to have solutions for operations issue	Limited knowledge for operation team in order to perform their work	Operation employee equipped with required skill and knowledge to perform their work	Limited knowledge and working process in operation team
Operation team will be able to decrease incidents that will cause operation delay	Avoidable incidents still exist	Ability to project avoidable and foreseeable incidents before working	comprehensive understanding on working with safety based on best pratices, and analyse working condition
Operation team will be able to meet deadline and target of production	Missing target of production and missed deadline	Target of production will be fulfilled and complete before deadline	Monitoring process in production target achievement
Measurement of employee performance and impact on trainings received	No process yet to measure employee performance	Employee will be able to achieve their performance and learning indicators and align with reward benefit	Performance indicators for operation employees
Innovation, best practices are growing from operation team supporting increase of productivity	P5M (pertemuan 5 menit) activity	Community of practice that support knowledge worker	Sharing activity in learning from experience, appliying best practices, sharing knowledge to support innovation

As we have defined and identified the organization capabilities gap, based on the knowledge management development phase critical knowledge will be detailed to

address the gap. This critical knowledge identification is important before advancing in creating the initiatives that will encapsulate and address the need for that knowledge.

Knowledge is considered critical when it is valuable and long-lasting enough to provide a sustained competitive advantage that justifies the expense of preserving it and passing it along from employee to employee. Every business has a different definition of critical knowledge, which is one of the main reasons why it is so important. Critical knowledge is frequently difficult to replace through hiring, if not impossible. It's the kind of expertise acquired via practical, day-to-day experience within a business (Harper, 2020).

Table 4. Organization capability Gap, Critical Knowledge

Gap	Critical Knowledge
Performance indicators for operation employees	1. professional behaviour 2. comprehensive leadership 3. reward and benefit appreciation
Limited knowledge and working process in operation team	1. team working skill 2. problem-solving skill 3. communication skill 4. ability to use mining software 5. analytical skill
operation team understand, adhere all existing SOP and policies in doing their work	1. comprehensive understanding of SOP and policies 2. behavioural change towards knowledge and standard
Absence of structured community of practice	1. community management skill 2. domain knowledge 3. engagement skill
comprehensive training policy that govern trainings to improve skills for operation employee for understanding on working with safety, best pratices, analyse working condition, also monitoring process in production target achievement	1. K3 (keselamatan dan kesehatan kerja) 2. water drainage for surface mining 3. operating heavy equipment 4. effective mining process 5. avoid excessive overcuts 6. mining plan knowledge 7. electricity setup in mining industry 8. complete knowledge on HSE 9. regulatory and industry standard knowledge 10. knowledge on planning activities 11. knowledge on supervising functions 12. ability to organize operation team 13. decision-making skill 14. supply-chain management
central server, folder repository and commmunication infrastructure covering all location	1. fluency on cloud based server usage 2. fluency on creating sharing folders
Fulfilment number of SOP that is established	1. ability to create structured SOP for operation team
Improved of sharing activity in learning from experience, applying best practices, sharing knowledge to support innovation	1. project management skill 2. documentation skill 3. presentation skill 4. creation of structured knowledge skill
Accessibility towards getting information is limited	1. skill for operation team on technology use 2. working knowledge of communication tools and application
internet connection in mining field	1. fluency on using internet
establishing real - time communication connection between sites	1. fluency on using communication application and tools
setup of real-time communication infrastructure to improve support	1. skill for remote support 2. fluency in using remote support tools

Business Objective	Capability Gap	Critical Knowledge	Business Strategy
Level up employee knowledge to Increase Productivity	operation team understand, adhere all existing SOP and policies in doing their work	1. comprehensive understanding of SOP and policies 2. working knowledge and standard	Working based on established standard operating procedure
	central server, folder repository and commmunication infrastructure covering all location	1. fluency on using internet 2. fluency on creating sharing folders 3. skill for operation team on technology use 4. working knowledge of communication tools and application 5. fluency on creating presentation and documentation	IT & communication infrastructure investment
	Limited knowledge and working process in operation team	1. K3 (keselamatan dan kesehatan kerja) 2. water drainage for surface mining 3. operating heavy equipment 4. effective mining process 5. avoid excessive overcuts 6. mining plan knowledge 7. electricity setup in mining industry 8. complete knowledge on HSE 9. regulatory and industry standard knowledge	Increasing knowledge on fundamental skill for mining and soft skill
	comprehensive understanding on working with safety based on best pratices, and analyse working condition	1. team working skill 2. problem-solving skill 3. communication skill 4. ability to use mining software 5. analytical skill	Increasing knowledge on fundamental skill for mining and soft skill
	Monitoring process in production target achievement	1. knowledge on planning activities 2. knowledge on supervising functions 3. ability to organize operation team 4. decision-making skill 5. supply-chain management	Increasing knowledge on fundamental skill for mining and soft skill
	Performance indicators for operation employees	1. professional behaviour 2. comprehensive leadership 3. reward and benefit appreciation 4. knowledge management	Focus on employee development to become more professional and becoming knowledge worker
	Sharing activity in learning from experience, appliying best practices, sharing knowledge to support innovation	1. knowledge management 2. managing meeting and communication skill 3. writing skill 4. project management skill 5. documentation skill presentation skill	Promoting culture of learning, sharing, documenting, and storing knowledge

Knowledge Management Objectives and Initiatives for Organization

As a result of the above analysis, we have identified critical knowledge and capability gaps for the organisation, and we are now moving on to identify knowledge management initiatives for the organisation to overcome and address the business objectives based on the critical knowledge required, as well as eliminating gap to be aligned with the business objectives for the operation team to be more productive. These will further explain in below table.

Table 5. KM Objectives, KM Initiatives Analysis

Critical Knowledge	KM Objectives	KM Initiatives
1. professional behaviour 2. comprehensive leadership 3. reward and benefit appreciation	Supporting personal development	1. setup of employee KPI 2. creation of employee reward and benefit program 3. regular acknowledgement of employee
1. team working skill 2. problem-solving skill 3. communication skill 4. ability to use mining software	Transform employees to be knowledge worker, with sufficient knowledge	1. training team working skill 2. training problem-solving skill 3. training communication skill 4. training how to use mining software
1. comprehensive understanding of SOP and policies 2. behavioural change towards knowledge and standard	Ensuring all employees understand, adhere all SOPs	1. Induction process for new employee 2. Regular mandatory check-ins for employee understanding of SOP's 3. Regular audit of employee SOP compliance
1. community management skill 2. domain knowledge 3. engagement skill	Community of practice and support creation	1. community management and engagement program 2. creation of learning community 3. subject matter expert
1. K3 (keselamatan dan kesehatan kerja) 2. water drainage for surface mining 3. operating heavy equipment 4. effective mining process 5. avoid excessive overcuts 6. mining plan knowledge 7. electricity setup in mining industry 8. complete knowledge on HSE 9. regulatory and industry standard knowledge 10. knowledge on planning activities 11. knowledge on supervising functions 12. ability to organize operation team 13. decision-making skill 14. supply-chain management	Provide policies to regulate mandatory trainings	1. training for K3 (keselamatan dan kesehatan kerja) 2. training for water drainage for surface mining 3. training for operating heavy equipment 4. training for effective mining 5. training for how to avoid excessive overcuts 6. training for mining plan 7. training for electricity setup 8. HSE refreshment training 9. regulatory and industry standard training 10. training knowledge on planning activities 11. training knowledge on supervising functions 12. training ability to organize operation team 13. training decision-making skill 14. training supply-chain management
1. fluency on cloud based server usage 2. fluency on creating sharing folders	Providing central server for KM resources easy access	1. Training on basic cloud server access 2. Training on creation of sharing folders, databases
1. ability to create structured SOP for operation team	To have adequate SOPs to regulate operation process	1. Training on how to create structured SOP
1. project management skill 2. documentation skill 3. presentation skill 4. creation of structured knowledge skill	Fostering collaboration for innovation and continous improvement	1. training for project management 2. training on documentation based on company standard 3. training on creating presentation and
1. skill for operation team on technology use 2. working knowledge of communication tools and application	Improved technology skill	1. Regular training of office application 2. Training of basic IT skills 3. Training of basic internet skills 4. Regular presentation session
1. fluency on using internet	Accessibility for all employee on informations and knowledge	1. Training of basic internet skills
1. fluency on using communication application and tools	Remove communication gap and achieve real time communication	1. Training of basic IT skills 2. Training of basic operation of communication tools
1. skill for remote support 2. fluency in using remote support tools	Seamless support	1. training on support for users 2. training on using remote application support tools

Business Strategy	KM Objectives	Critical Knowledge	KM Initiatives
Working based on established standard operating procedure	Ensure all employees understand all SOPs	1. comprehensive understanding of SOP and policies 2. working knowledge and standard	1. Induction process for new employee 2. Regular review, update, and creation of SOP 3. Regular audit of SOP compliance 4. Regular mandatory check-ins for employee understanding of SOP's
	To have adequate SOPs to regulate operation process		
IT & communication infrastructure investment	The right use of technology for KM system	1. fluency on using internet 2. fluency on creating sharing folders 3. skill for operation team on technology use 4. working knowledge of communication tools and application 5. fluency on creating presentation and documentation	1. Regular training of office application 2. Training of basic IT skills 3. Training of basic internet skills 4. Regular presentation session 5. Community of practice and group sharing session
	Remove communication gap and achieve real time communication		
	Seamless Support		
	Create easy to find and access to knowledge and communication		
	Providing central server for KM resources easy access		
Increasing knowledge on fundamental skill for mining and soft skill	Transform employees to be knowledge worker, with sufficient knowledge	1. K3 (keselamatan dan kesehatan kerja) 2. water drainage for surface mining 3. operating heavy equipment 4. effective mining process 5. avoid excessive overcuts 6. mining plan knowledge 7. electricity setup in mining industry 8. complete knowledge on HSE 9. regulatory and industry standard knowledge	1. training for K3 (keselamatan dan kesehatan kerja) 2. training for water drainage for surface mining 3. training for operating heavy equipment 4. training for effective mining 5. training for how to avoid excessive overcuts 6. training for mining plan 7. training for electricity setup 8. HSE refreshment training 9. regulatory and industry standard training 10. Community of practice and group sharing
	Provide policies to regulate mandatory trainings	1. team working skill 2. problem-solving skill 3. communication skill 4. ability to use mining software 5. analytical skill	1. training team working skill 2. training problem-solving skill 3. training communication skill 4. training how to use mining software 5. training analytical skill
		1. knowledge on planning activities 2. knowledge on supervising functions 3. ability to organize operation team 4. decision-making skill 5. supply-chain management	1. training knowledge on planning activities 2. training knowledge on supervising functions 3. training ability to organize operation team 4. training decision-making skill 5. training supply-chain management
Focus on employee development to become more professional and becoming knowledge worker	Supporting personal development	1. professional behaviour 2. comprehensive leadership 3. reward and benefit appreciation 4. knowledge management	1. setup of employee KPI 2. creation of employee reward and benefit program 3. regular acknowledgement of employee
Promoting culture of learning, sharing, documenting, and storing knowledge	Improved sharing knowledge activities, collaboration to support better decision making.	1. knowledge management 2. managing meeting and communication skill 3. writing skill 4. project management skill 5. documentation skill presentation skill	1. improvement on P5M activities 2. creation of documentation process from past experience and best practices
	Fostering collaboration for innovation and continous improvement		1. regular knowledge sharing activities 2. regular group discussions 3. online community forum 4. community of practice

Having those initiatives above will give the organisation the ability and improvement in sharing ideas, collaboration, better and on-target decision making, access to the most up-to-date information, improve employee awareness, increasing innovation, and supporting the development of the operation team, resulting in a more productive team.

The importance of initiating and executing plan and initiatives for all enabler aspect of knowledge management such as people, process, and information technology. Each of enabler interconnecting each other and cannot stand of its own to reach the organization objectives in implementing knowledge management system. It can be shown in below figure.

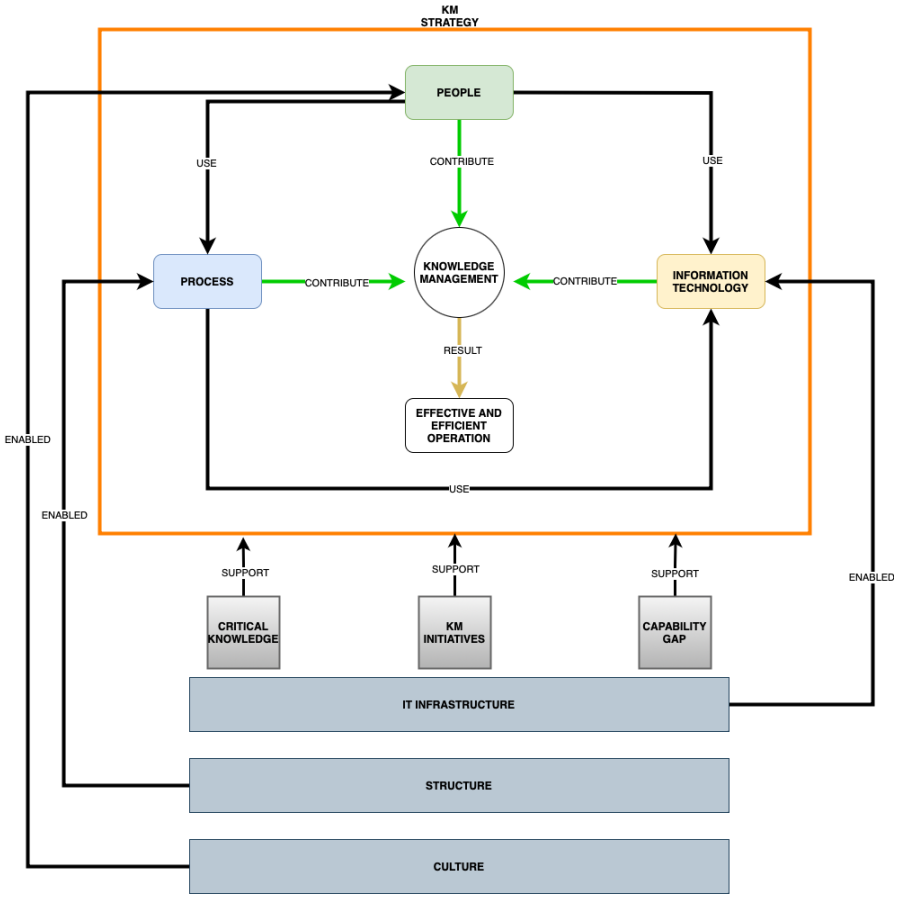

Figure 6. Interconnection of KM Enabler

Implementation Plan & Justification

From Jann framework model of knowledge, it is imperative that improvement on trust, culture, and learning environment would be the foundation to support the knowledge management for the system to work and resulted the company as learning organization. The company would need to facilitate with initiatives to support improvement in trust, culture, and learning.

As the first step is to create a steering committee that will oversee the knowledge management system. The committee will consist of HR, operation, and information technology representatives. By forming the committee, would help to make sure that knowledge management system would be running as expected by the company and help to reach the goal of the company.

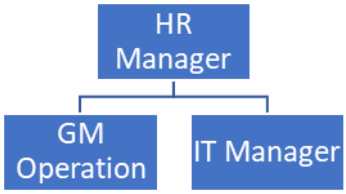

Figure 7. KM Steering Committee

In the committee HR will lead with managing all the initiatives, review, and updates on the system. As the first step to improve trust, culture, and learning by forming below initiatives. Eventually these initiatives will create a learning habitat.

- Acquiring support from higher management on KM initiatives.

- Integrating KM process into business process
- Reward and benefit program should be implemented and integration of learning hours into KPI.
- Implementation of change management that include knowledge management as part of the process.
- Forming a community of practice and appoint and acquire knowledge supplier and subject matter expert and codification of explicit knowledge.
- Regular schedule of review, curation, and update of knowledge. To make sure that knowledge that the company have is relevant and updated.
- Train the trainer program, case study and group discussion program.
- Knowledge management introduction activities, to get trust that KM will help in personal development as well.
- Creating safe learning environment to make sure that all employees can be open, answering question or give opinion will be appreciated and not ridiculed, retaliate during discussion or sharing session.
- Discussion environment that has no blaming game especially in discussion when failure happen, resulting to a productive session.
- Facilitated the KM system, knowledge supplier, as well as employees to have easy access to search, contribute for knowledge sharing and documentation to further enable community of practice.
- Ensuring understanding of managers on their role in knowledge management.
- Soft skill and other mining technical training program to help operation team to be more professional and becoming knowledge worker.

Based on the analysis, infrastructure for communication and a central server must be built up to support the knowledge management system infrastructure and ensure that flow communication occurs in real time. Proposed infrastructure includes establishing internet connection in mining field site and setup a central server on cloud. Users will be able to access the central server on cloud with variety of devices including mobile as well for easy access.

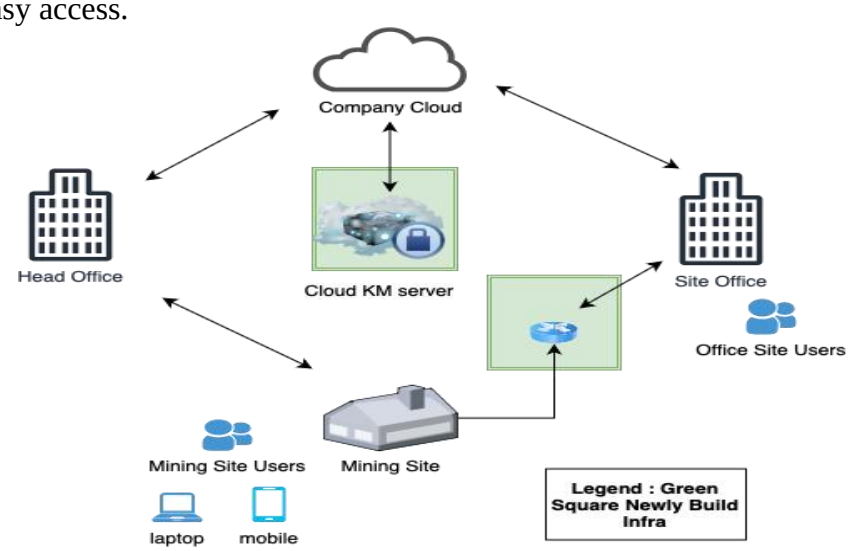

Figure 8. Central Server and Communication Diagram

Conclusion

The goal of this research is to develop a knowledge management strategy plan for the company's operations team. Recalling the research questions from **chapter I**, the purpose is to maximized operation teamwork and effectively attain the company's goal.

An interview was done to collect data from the operation team in order to identify existing difficulties and challenges that operation team facing such as lack of skills, poor people development, absence of information or knowledge sharing culture, professionalism, and poor reward and benefit system, and inadequate technology assistance have been identified as challenges in the organization that contribute to low productivity. Those that are causing their job to be ineffective and inefficient **figure 4.1 (page 54)** thus causing low productivity. Furthermore, the organization lacks a knowledge management system as well as any initiatives to help the operations team be more productive in their day-to-day operations and increase operation productivity. Aside from the current situation, the data is also used to determine an organization's readiness for knowledge management, as described in **chapter IV**.

With the absence of knowledge management, there are gaps between existing organizational competencies and expected capabilities. These capability deficits are documented in **table 4.3 (page 63)**. The table identifies key knowledge required to further minimize or close the gap, and the analysis in **table 4.4 (page 64)** details the list of critical knowledge required for the operation. Based on identified critical knowledge, the development of knowledge management initiatives and the technology to support them in **chapter IV**, compiling those initiatives and turn it into KM strategy **table 4.7 (page 74)** as well and its roadmap **figure 4.6 (page 73)** as the reference for implementation. Further on that the specific timeline to implement a knowledge management system will be explain in **table 4.6 (page 70)**.

With the knowledge management system implemented it will further help operation team to further increase their productivity as well as develop their professionalism. With implementation of knowledge management will also help to grow innovation in the company and it will support the growth of the company to compete with other mining companies.

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