Mining Contract Lifecycle Management Maturity Assessment: Case Study PT Kaltim Prima Coal

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Abstract. PT Kaltim Prima Coal (KPC) is an Indonesian incorporated company that engages in coal mining and sales for both domestic and international customers from various industrial sectors. KPC manages a mining area of 84,938 hectares in Sangatta, Bengalon and Rantau Pulung, East Kalimantan, Indonesia. Supported by more than 4,199 employees and more than 21,000 personnel from contractors and associated companies, KPC's coal production capacity reaches 70 million tonnes per year. KPC manages three main mining contracts, all of which are overseen by the Contract Mining Division (CMD). Mining contractors are responsible for more than half of overburden removal and coal mine production, according to the last ten years history and the long term mine plan beyond 2021. CMD will need mature and good contract and contractor management to ensure that KPC's total production targets are met without major setbacks. Therefore, a measurement of CMD's present maturity level in handling mining contracts and contractors is required. The goal of the research is to conduct a maturity assessment by surveying mining contract lifecycle management staff to determine the current level of maturity and to develop a plan to close the gap between the current and maximum maturity levels using cause and effect analysis. The research revealed 37 viable solutions based on cause and effect analysis, which are recommended for execution as quick wins and major projects after being prioritized based on impact-effort analysis.

Keywords: Contract Lifecycle Management; Maturity; Mining Contracts

1 Introduction

Mining is a high-tech, capital-intensive, and high-risk business. Mine design, drilling, blast material, material removal, equipment maintenance, mine scheduling, and budgeting are all part of mining operations. Mine management is frequently faced with the decision of whether to execute all major mining activities with their own equipment and employees or to outsource some or all of them to specialized mining contractors. When a mine's owners hire professional contractors to undertake various mining operations like drilling, blasting, material removal, equipment maintenance, processing operations, scheduling, and budgeting, they are known as contract mining [1]. Contract mining or owner mining systems are used by the majority of mining businesses in Indonesia and around the world. Over the last two decades, contract

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mining has exploded all over the world. Mining companies can focus on their core activities by contracting out one or more of their operations, allowing them to hire experts for rock breaking, raw material preparation, and material handling. Contract mining operations are now predicated on risk allocation to the party best able to handle the risk, from exploration to exploitation and final product transportation. In every cycle of contract management, owner mining should examine potential risks while contracting one or more mining activities. PT Kaltim Prima Coal (KPC) is an Indonesian incorporated company that engages in coal mining and sales for both domestic and international customers from various industrial sectors. KPC manages a mining area of 84,938 hectares ha in Sangatta, Bengalon and Rantau Pulung, East Kalimantan, Indonesia. Supported by more than 4,199 employees and more than 21,000 personnel from contractors and associated companies, KPC's production capacity reaches 70 million tonnes per year. KPC's total coal reserve as of the end of 2020 is 1,015.1 million tonnes of coal [2].

Fig. 1. KPC Mining Site (2020 KPC Sustainability Report)

Coal mining activities in KPC are carried out by our KPC own mining operation and several mining contractor partners. 8 pits are directly operated by KPC own mining, while 7 others are operated by the mining contractors under KPC's supervision. In its operations, KPC never partners with artisanal and small-scale mining (ASM) [2]. The mining process at KPC is often separated into three phases: pre-mining, mining, and post-mining. *First*, the pre-mining phase begins with an exploratory survey and soil composition examination to obtain data for coal resource and reserve modeling; onsite infrastructure construction, such as roads, bridges, buildings, sediment ponds, crushers, and overland conveyors; securing vegetation seed prior to disturb activities; wildlife relocation, such as orangutans to a safe conservation area; and land clearing, soil recovery, and stockpiling for ongoing rehabilitation. *Second*, the mining step entails drilling and blasting to break up overburden or coal in order to maximize material removal productivity; coal processing, from crushing to washing for dirty coal, coal reclaims, and conveying to port destination; overburden removal to waste dump and coal delivery to stockpile or crusher; coal stockpiling at Port Terminal; and coal reclaiming, loading, and shipment to customer vessels and barges. *Third*, the post-mining phase includes reclamation and rehabilitation of the final waste dump and void by spreading soil and planting plants, biodiversity monitoring in the reclamation region, and post-mining area utilization such as farms, plantations, recreations, and so on. Apart from using its own resources, KPC also works with partners, in this case, suppliers and contractors, to complete these three phases. Land clearing, soil recovery and stockpiling for ongoing rehabilitation, overburden removal to the

waste dump, coal delivery to the stockpile or crusher, and reclamation and rehabilitation of the final waste dump and void by spreading soil and planting vegetation are all activities performed by mining contractors as KPC partners. The figure below depicts a summary of the KPC Mining Process Phase [3].

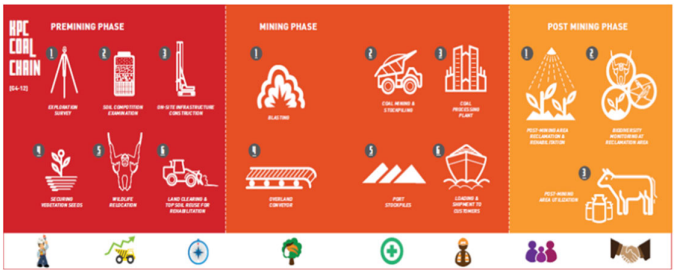

Fig. 2. KPC MiningProcess Phases (2014 KPC Sustainability Report)

The Contract Mining Division (CMD) is one of KPC's divisions in charge of overseeing mining contractors in order to achieve the company's vision and goal. KPC manages three main mining contracts, all of which are overseen by the CMD. From contract preparation through contract close-out, CMD oversees the whole mining contract lifecycle. Mining contractors are responsible for more than half of coal mine production, according to historical data and projections for the next ten years. Based on this data, it can be stated that mining contractors play a crucial role in KPC's ability to meet its output targets. KPC has started to tender for mining contracts after the expiration of the Coal Contract of Work (CCOW) on December 31st, 2021, based on the needs of the Life of Mine Production Plan 2022–2041. Some of the challenges that will be faced and managed properly with mining contractors if KPC binds mining contractors with contracts to work on some of its production targets are:

a) With a considerable amount of KPC's production coming from contractors, CMD, as the division in charge of overseeing mining contractors, needs mature and outstanding contractor management to ensure that KPC's production and income targets are met without difficulty.
b) As a result, a measurement of CMD's present maturity level in handling mining contracts and contractors is required. CMD has never conducted a maturity assessment of mining contract management before.

The graphs below show the current and prospective coal production composition by KPC's own mining and contractors.

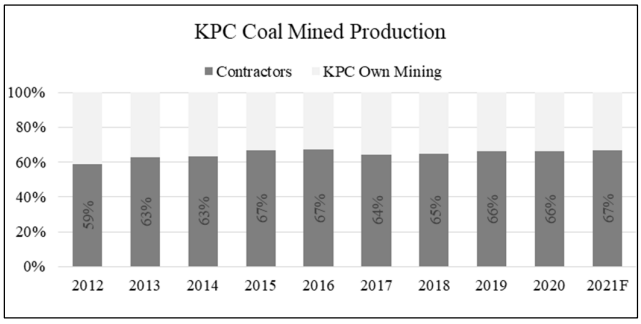

Fig. 3. KPC Actual Coal Mine Production (KPC internal data analysis)

Fig 4. KPC Plan Coal Mine Production (KPC internal data analys)

1.1 Objective

The following are the research's objectives:

a) Conduct a maturity level survey of the organization's mining contract lifecycle management to determine the current position level based on documents and contract management personnel's experience;
b) Develop a plan to close the gap between the survey results and the maximum maturity level in order to reduce overall mining contract lifecycle implementation risk.

1.2 Limitation of The Research

In order to maintain consistency in research, there are several limitations in this study:

a) Analysis is limited to managing mining contracts and mining contractors as a CMD organization;
b) Only CMD workers were used as research subjects for the survey, interview, and group discussion;
c) The numerous positions in CMD that are the subject of the survey to collect data are Senior Engineers, Superintendents, and Managers.

2 Literature Review

2.1 Contract Lifecycle Management

According to David Lowe [4], contract management has been defined as "... the process which ensures that all parties to a contract fully understand their respective obligations, enabling these to be fulfilled as efficiently and effectively as possible to provide even better value for money''. This procedure begins with the identification of the buyer's requirements and ends with the signing of the contract. Furthermore, the procedure has two distinguishing features:

a) Contract performance risk identification, apportionment, and management;
b) Managing the relationship between the buyer and the provider.

Contract management is also defined as the art and science of managing a contractual agreement (s) throughout the contracting process [5]. Contract Lifecycle Management (CLM) simply refers to the effective management of contracts or agreements, as well as the relationships between entities, through proper planning of all contract management stages,

resulting in the reduction, elimination, or mitigation of financial, legal, and procurement risks [6]. Starting with the contract request process, CLM is critical in managing contracts and contractors at all stages of the contract or contract lifecycle. - contract drafting-tendering-contract approval - contract execution -obligation management-contract compliance -contract review, analysis, close-out, and improvement. -contract review, analysis, close-out, and improvement. A good application of CLM can provide maximum benefits to the company [7], such as:

a) Cost-effectiveness. Enables cost-cutting throughout the tendering or contract management processes and provides benefits through regular performance reviews, service improvement, and innovation.
b) Using strong contract management procedures to reduce contract risk.
c) Manage contractor performance, maintain quality, increase efficiency, and look for opportunities for improvement and innovation to maximize end-user results.

The contract management lifecycle is complex. Failure in this case will cost money and lose customers. In general, according to Cassidy [8], the contract lifecycle process consists of:

a) Requests. Contract lifecycle management begins with the contract requesting process, in which one party requests or initiates the contracting process, then uses that information to construct or author the contract document. The initial step in contract lifecycle management is usually this.
b) Authoring and negotiations. During the contract authoring or drafting stage, a contract or agreement document with all provisions, terms, and conditions is established. Contract approvers and signing parties are normally chosen at this step, and approver and signing data are recorded in the contract document.
c) Approvals. The agreement document created in the preceding phase is presented to internal or external approvers, who must approve the document in order for it to move forward in the CLM lifecycle.
d) Execution and agreement signing. Once a contract has been accepted, it is delivered to the appropriate parties for signature, either electronically or manually.
e) Contract database. Once a contract is signed, it is permanently saved in an easy-to-find agreement database. Documents and contract metadata are indexed and saved for future use.
f) Obligations and compliance. When the contract is being executed, all of the contract's obligations must be met, and compliance with the contract and other requirements must be maintained.
g) Renewals. When a contract expires, it must be renewed to keep it active. The parties concerned may incur financial implications if the contract is not renewed on time.

Fig. 5. Contract Lifecycle Management (Cassidy, 2019)

2.2 Contract Lifecycle Management Maturity Model

Many businesses have evaluated the capacity and maturity of their most key processes using capability maturity models. In these maturity models, process capability is defined as "the inherent ability of a process to produce planned results" [9], and maturity is defined as "a measure of effectiveness in any specific process" [10]. The Software Engineering Institute (SEI) Capability Maturity Model (SEI CMM), People Capability Maturity Model (People CMM), and Project Management Maturity Model (PMMM) are some of the more well-known capability maturity models. The majority of maturity models are based on a succession of maturity levels, with each maturity level indicating the process' level of competence. As the organization obtains process competence, the maturity scale rises. Maturity increases capability and predictability while lowering risk. Rendon created the Contract Management Maturity Model in 2003, which was the first time the maturity model concept was applied to contract management procedures in an enterprise.

The Contract Management Maturity Model (CMMM) was created to assess an organization's contract management processes' capability and maturity, in response to the procurement function's growing importance and transformation from a tactical to a strategic perspective, as evidenced by procurement literature [11]. The CLM Maturity Model is a technique for assessing the maturity of a company's contract management process. The benefit of analyzing an organization's contract management process maturity is that the results may be used to create a road map for improving contract management process maturity over time, according to Rendon et al. [12]. According to Randon [13], Five Levels of CLM Maturity consists of five levels of maturity, ranging from ad hoc (Level 1) to a basic, disciplined process capability (Level 2), a fully established and institutionalized process capability (Level 3), a level characterized by processes integrated with other corporate processes resulting in synergistic corporate benefits (Level 4), and finally, a level in which processes are integrated with other corporate processes resulting in synergistic corporate benefits (Level 5).

a) *Level 1—Ad Hoc*. At this level of maturity, the organization recognizes the existence of contract management processes, as well as the fact that these processes are widely accepted and used in both the public and private sectors. Furthermore, the organization's management understands the advantages and value of contract management methods. Although no established core contract management procedures exist at the organization level, some established contract management processes do exist and are employed inside the organization. However, these established processes are only applied to specific contracts on an ad hoc and sporadic basis. The contracts to which these methods are applied have no rhyme or reason. Furthermore, the organization has informal contract management process paperwork, but it is only used on an ad hoc and occasional basis on various contracts. Finally, no one holds organizational managers or contract management professionals responsible for following or adhering to any basic contract management processes or standards.
b) *Level 2—Basic*. At this maturity level, organizations have established some basic contract management processes and standards within the organization, but these processes are only required on certain complex, critical, or high-visibility contracts, such as contracts with specific customers or contracts exceeding certain dollar thresholds. Some formal documentation has been generated for these established contract management methods and standards. Furthermore, the business does not believe that these contract management practices or standards have been adopted or institutionalized throughout the organization. Finally, there is no organizational policy requiring constant use at this maturity level.

c) *Level 3—Structured*. At this maturity level, contract management processes and standards have been completely created, institutionalized, and mandated throughout the company. Formal documentation has been established for various contract management processes and standards, and certain activities may even be automated. Additionally, because these contract management processes are required, the organization provides for customization of processes and documentation to account for the specific elements of each contract, such as contracting strategy, contract type, terms and conditions, monetary amount, and type of necessity (product or service). Finally, senior organizational management plays a role in providing direction.

d) *Level 4—Integrated*. In businesses at this maturity level, contract management processes are fully integrated with other organizational core activities such as financial management, schedule management, performance management, and systems engineering. In addition to representatives from other organizational functional offices, the contract's end-user customer is an important member of the buying or selling contracts team. Finally, metrics are used on a regular basis by the organization's management to review various areas of the contract management process and make contract-related choices.

e) *Level 5—Optimized*. The greatest level of maturity represents a company whose management employs performance metrics to measure quality and analyze the efficiency and effectiveness of contract management processes on a regular basis. This level also implements continuous process improvement efforts to improve contract management processes. Furthermore, to strengthen contract management processes, standards, and documentation, the business has created best practices and lessons learned programs. Finally, as part of its ongoing process improvement effort, the organization undertakes contract management process simplification activities.

A company's capabilities and efficacy in its important contract management process can be assessed using these five stages of maturity. The figure below depicts the leveling of CLM Maturity [14].

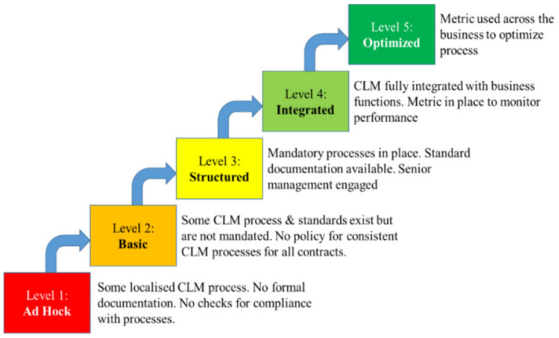

Fig. 6. CLM Maturity Level (Linsley, 2019)

3 Methodology

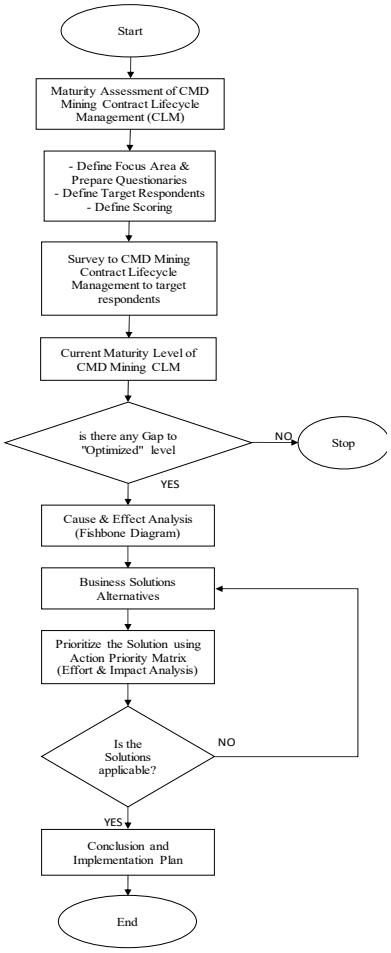

Fig. 7. Research Methodology

The figure above illustrates the research methodology of this paper. The first phase is to conduct a maturity assessment of the mining contract lifecycle management in CMD. To carry out this assessment, the first step is to determine the focus area to be assessed, the questionnaires to be prepared, the target respondents and the scoring method. The second step is to prepare and conduct a survey method for maturity assessment with the selected respondents, namely personnel involved in mining contract lifecycle management at CMD, both management (i.e., all managers) and practitioners (i.e., superintendents and some senior engineer staff). The third phase is to analyze the results of the maturity mining contract lifecycle management assessment survey at CMD at which level as a whole and at which level in each focus area. The next fourth phase is to perform a focus group discussion with some mining contract lifecycle management practitioners to analyze the gap between the current maturity level compared to the ideal or maximum maturity level and find the root cause of

each reason the maturity level is low, using the cause-effect analysis method or fishbone diagram analysis. The fifth phase, after finding the root causes from the cause-effect analysis, develops alternative solutions that are prioritized using effort-impact analysis and plotted on the action priority matrix to get quick wins and major project solutions as a conclusion to the implementation plan.

4 Results and Discussion

4.1 CLM Maturity Assessment

An assessment survey of key stakeholders involved in mining contract lifecycle management at CMD was undertaken to determine the CLM maturity level of CMD as the Division responsible for contract mining management at KPC. According to Rod Linsley, there are 10 focus areas with a total of 96 survey questions [14].

Table 1. CLM focus area covers

Focus Area	Covers
The Governance Environment	Strategy, policies, standard practices, roles and responsibility
Risk Management	Allocation, mitigation ownership, reporting
Performance Management	Contract service delivery, the CLM function, reporting
Change Management	Standard approaches, authorization, reporting
Financial Management	Pricing correctness, payment, price reviews, penalties, reporting
Dispute Management	Standard resolution options, reporting
Contract Disengagement	Standard activities, residual obligations, lesson learned
CLM Staff Capabilities	Skills needed vs available, training and certification, performance assessment
Technologies	Fitness for purpose, level of adoption, integration capabilities
Assurance Systems	Compliance oversight, compliance practice

It's logical to assume that the primary people involved in the CLM maturity assessment will be those who work with CLM the most. Even in the most inexperienced organizations, there will be many others who can influence or be influenced by CLM methods.

Table 2. CLM assessment target participant

Requirement	Who	Why
Must	CLM practitioners	Deeply involved in CLM activities
Must	CLM management	Responsible for effective performance of CLM function

The score range utilized gives a basic idea of the possibility of a scenario stated in the survey occurring.

Table 3. Likelihood scoring

Likelihood	N/A	Never	Seldom	Sometimes	Mostly	Always
Score	0	1	2	3	4	5

The actual score (or averaged score if several assessors are used) assigned as a percentage of the maximum score attainable for that focus area determines the CLM maturity level for that focus area. The overall CLM maturity level of an organization is determined by the total score assigned across all emphasis areas as a percentage of the maximum score achievable across the full survey.

Table 4. Maturity level scoring

Maturity Level	Ad Hoc	Basic	Structured	Integrated	Optimized
Start Score %	0	50	75	86	95

4.2 Assessment Result Findings

The current maturity level is "*Structured*", while the ideal maturity level is "*Optimized*", according to the survey results. As a result, there's a gap or problem between what's current and what's ideal or maximum. The table and graph below show a summary of the survey results for each focus area.

Table 5. CMD CLM Current Maturity Level

No	Focus Area	Actual	Maturity
1	The Governance Environment	4.03	Structured
2	Risk Management	4.08	Structured
3	Performance Management	4.43	Integrated
4	Change Management	4.12	Structured
5	Financial Management	4.28	Structured
6	Dispute Management	4.50	Integrated
7	Contract Disengagement	4.29	Structured
8	CLM Staff Capabilities	4.02	Structured
9	Technologies	3.42	Basic
10	Assurance Systems	4.03	Structured
	Total average	4.12	Structured

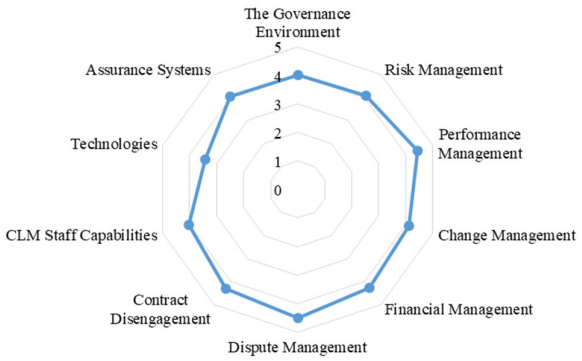

Fig. 8. Spider Graph Current CMD CLM Maturity Level (Analysis)

According to the table and graph above, the current maturity level is "*Structured*" on average. As a result, all focus areas are below the "*Optimized*" ideal level. To determine the root cause, it is required to examine the gap and root cause, and then build a solution to close the gap. The largest difference is in technologies, which are classified as "*Basic*", while the smallest gap is in performance management and dispute resolution, which are classified as "Integrated".

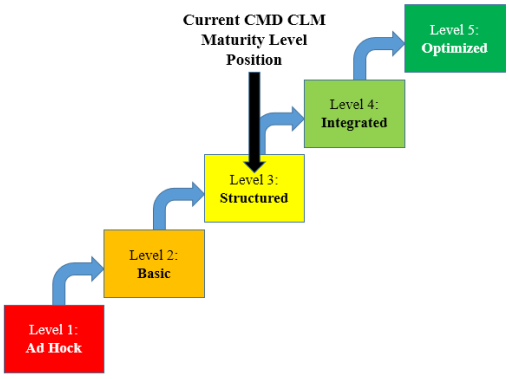

Fig. 9. Current CMD CLM Maturity Level Position (Analysis)

We also acquire the explanations or causes of the gap, as well as difficulties or risks if the gap is not closed, from the survey data. The current maturity level of CLM CMD is still 2 (two) levels below the maximum level, with a "*Integrated*" level above the "*Structured*" level before advancing to the "*Optimized*" level, according to these findings. To close this gap, it is vital to examine prioritized initiative solutions.

4.3 Cause and Effect Analysis

Cause and Result diagrams, according to Cadle et al [15], are a highly visual manner of demonstrating how an unwanted effect or problem (for example, low system availability) is related to its causes. This design is also known as fishbone diagrams or Ishikawa diagrams, which were popularized by Kaoru Ishikawa (1915–1989). The gaps in each emphasis area are made up of the details of each statement, according to the results of the maturity survey in the previous analysis. We also calculated a maturity gap between actual and maximum maturity for each statement, where the gap represents the risk that will occur in CLM activities at CMD. For each emphasis area described below, after defining the effect based on risk, the reasons for each effect are sought using cause and effect analysis using a fishbone diagram.

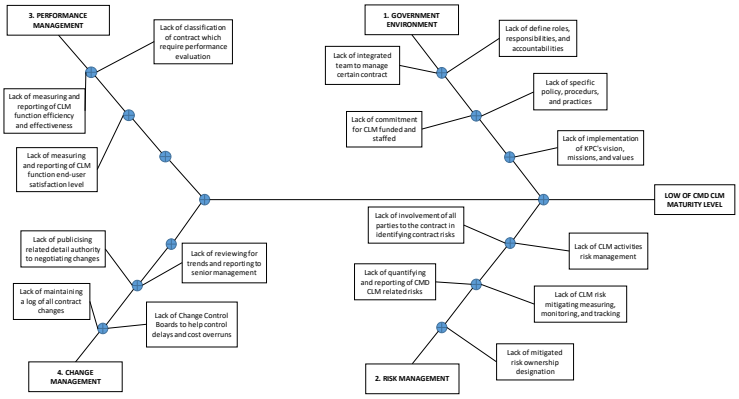

Fig. 10. Cause-Effect Diagram for Government, Risk, Performance, and Change Management (Analysis)

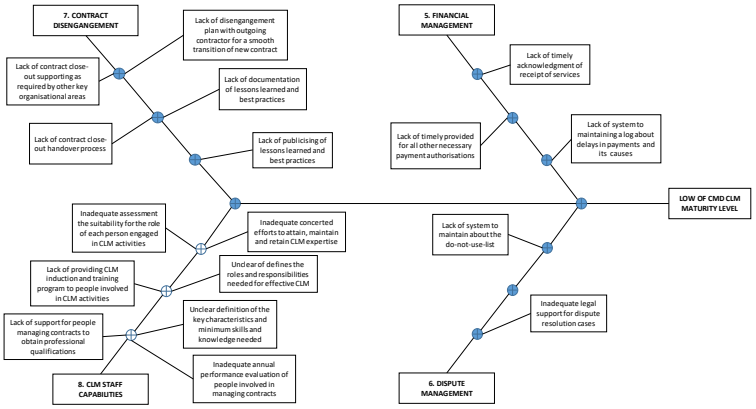

Fig. 11. Cause-Effect Diagram for Contract Disengagement, CLM Staff Capabilities, Financial and Dispute Management (Analysis)

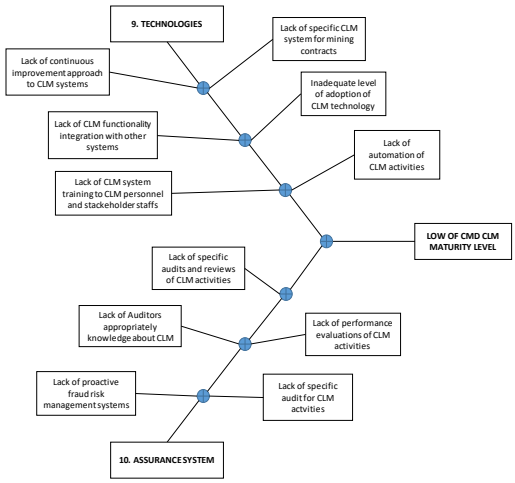

Fig. 12. Cause-Effect Diagram for Technologies and Assurance System (Analysis)

4.4 Alternative Solution Discussion

The author proposes alternate remedies for each of the problems found based on the cause-and-effect analysis presented in the previous analysis. For each problem in each focus area, alternative solutions will be developed. There are 37 alternative strategies for resolving the core reasons of low CMD CLM maturity. The author employs the Impact-Effort analysis method to prioritize various solutions. Impact scores ranging from 0 to 10 will be used to efficiently employ the strategy, with '0' reflecting no impact and no effort and '10' representing maximum impact and greatest effort. The activities of the Action Priority Matrix can be plotted more precisely using this score, resulting in a simpler priority selection. An Action Priority Matrix (APM), according to Mulder [16], makes decision-making easier by explicitly specifying which actions must be finished on time and which can be omitted or completed

later. An Action Priority Matrix is a basic diagramming approach that can help you decide which activities to prioritize so that you can make the most of your time. In an APM, the activity's efforts (x-axis) are shown perpendicularly on the Impact/details (y-axis). The figure below illustrates the alternative solutions that have been included in the Action Priority Matrix (APM) based on priority Impact-Effort analysis.

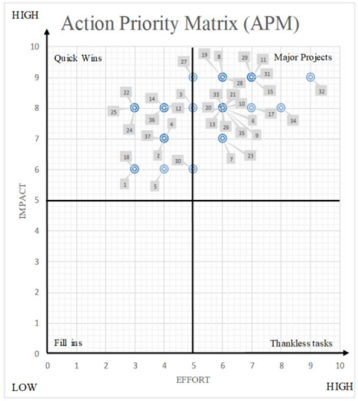

Fig. 13. Action Priority Matrix of alternative solutions (Analysis)

According to the APM, there are two types of action plans to be implemented: Quick Wins, which must be completed quickly due to minimal work but great impact, and Major Projects, which must also be completed quickly but demand a lot of effort in terms of time and money. As a result, the fast wins quadrant will implement alternate solutions for short-term priorities, whereas the large projects quadrant will implement long-term priorities. The table below lists all of the prioritized solutions.

Table 6. Quick Wins Solutions

Ref	Alternative Solutions
1	Re-socialization of KPC's vision, missions, and values
2	Develop structure organization for CMD CLM activities
3	Develop specific policy for CMD CLM activities
4	Compile existing procedures and practices related to CMD CLM activities
5	Socialize existing and new procedures and practices related CMD CLM activities
12	Check and ensure clear, measurable, and relevant KPI for Key or Strategic contracts including in contract document with contractors
14	Check and ensure contract changes procedure including authority to negotiating already stipulated in the contract document with contractors
18	Review existing procedures for payment to mining contracts/contractors
22	Check and review contract document related termination contract cause of default
24	Check and review contract document related contract close-out including verification of final handover
25	Check and review contract document related smooth contract transition
27	Check and review contract document and develop procedures to process for storage, handling and disposal of contract files, the return or destruction of any confidential information, the return of any loaned items, the transferal of any Intellectual Property rights, and where applicable the provision of a copy of the organization’s data from the contractor’s computer systems

Ref	Alternative Solutions
30	providing comprehensive CLM induction and training programs to people involved in CMD CLM activities
36	Conduct annual CMD CLM maturity survey
37	Refresh and regular socialization of KPC code of conduct to all CMD CLM staff

Table 7. Major Projects Solutions

Ref	Alternative Solutions
6	Redefine roles, responsibility, and accountability of CMD CLM personnel in position description
7	Develop procedure for assembling of integrated team which involving legal, finance, and procurement for certain contract
8	Develop Manual, Element, & Process of CMD CLM systems
9	Develop system for risk management related to contract lifecycle (CLM) activities
10	Develop procedure for risk management related CLM
11	Develop system or procedures of contract & contractor performance management
13	Develop procedure to measuring and reporting of CMD CLM function efficiency and effectiveness; End-user satisfaction level on CMD CLM function
15	Develop procedure to contract changes
16	Develop procedure for maintain, review for trends, and report to senior management a log of all contract changes
17	Develop system to establish Change Control Boards for large-scale, lengthy and complex contracts to help control delays and cost overruns
19	Revise existing procedures for payment to mining contracts or contractors
20	Socialize revised procedure related payment to mining contracts/contractors to all CMD CLM staffs
21	Develop procedure for providing legal support for dispute resolution cases
23	Develop policy, procedure and guideline for covering on a do-not-use-list contractor, maintain and made available to appropriate people
26	Develop procedure to provide support for contract close-out from other key organizational like legal and finance
28	Develop procedure to document and publicize lesson learned and best practice to continuously improve contract management and use for subsequent contracts
29	Develop system and procedure related CLM staff capabilities
31	Develop specific CMD CLM same system for mining contract
32	Buy and install CLM software which can integrate with other system such as finance
33	Train new system or software to CLM staff and CLM stakeholder
34	Develop procedure to conduct Risk-based audit for CLM activities in CMD
35	Develop procedure to conduct performance evaluation of CLM activities in CMD

5 Conclusion

According to the analysis performed in this research, it can be concluded:

a) The current maturity level of mining contract lifecycle management at CMD is average at a "Structured" level, which is still two levels below the level "Optimized," which should be the target, goal, or maximum level in managing the mining contract lifecycle.
b) A gap or risk exists between the maximum maturity level and the present or actual maturity level of CMD's mining contract lifecycle management activities, necessitating the development of an improvement action plan to ensure that the gap or risk can be closed, decreased, or even eliminated.

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