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SOFT SYSTEM METHODOLOGY (SSM) APPROACH TO ADDRESS ORGANIZATIONAL INEFFICIENCIES IN HUFF AND PUFF OPERATIONS

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ABSTRACT

The success of maintaining production in heavy oil fields is highly dependent on the effectiveness of Huff and Puff operations. However, in practice, this effectiveness is often hampered by technical limitations, budget constraints, organizational incompatibilities, and administrative inefficiencies. This study highlights issues at PT Energi Mega Persada (EMP), where a lack of communication and coordination between the engineering team, field teams (production and well service), and support functions (finance, procurement, and SHE) creates significant operational barriers. Each function has different priorities engineering focuses on reservoir optimization, field teams on operational execution, and support functions on regulatory compliance and budgeting but there is no integrated mechanism to align these priorities. This research uses Soft Systems Methodology (SSM) as a managerial approach to analyze organizational dynamics and identify root causes from the perspective of various stakeholders. Through systemic mapping of inter-functional conflicts and barriers, SSM enables the development of an integrated strategy that integrates technical and managerial decisions. The analysis results show that operational success is not solely determined by technology, but also by cross-functional collaboration, adaptive leadership, and integration between corporate strategy and operational conditions in the field. The application of SSM helps EMP formulate a more efficient, responsive, and aligned coordination framework with long-term production goals.
Keywords: heavy oil field, Huff and Puff, Soft Systems Methodology (SSM), managerial decision-making, cross-functional collaboration.

ABSTRAK

Keberhasilan mempertahankan produksi di lapangan minyak berat sangat bergantung pada efektivitas operasi Huff and Puff. Namun, dalam praktiknya, efektivitas tersebut sering terhambat oleh keterbatasan teknis, anggaran, serta ketidaksesuaian organisasi dan inefisiensi administratif. Studi ini menyoroti permasalahan di PT Energi Mega Persada (EMP), di mana kurangnya komunikasi dan koordinasi antara tim engineering, tim lapangan (produksi dan well service), serta fungsi pendukung (keuangan, pengadaan, dan SHE) menimbulkan hambatan operasional yang signifikan. Masing-masing fungsi memiliki prioritas berbeda engineering fokus pada optimasi reservoir, tim lapangan pada eksekusi operasional, dan fungsi pendukung pada kepatuhan regulasi dan anggaran namun tidak terdapat mekanisme terpadu untuk menyelaraskan prioritas tersebut. Penelitian ini menggunakan Soft Systems Methodology (SSM) sebagai pendekatan manajerial untuk menganalisis dinamika organisasi dan mengidentifikasi akar masalah dari perspektif berbagai pemangku kepentingan. Melalui pemetaan sistemik terhadap konflik dan hambatan antarfungsi, SSM memungkinkan penyusunan strategi terpadu yang mengintegrasikan keputusan teknis dan manajerial. Hasil analisis menunjukkan bahwa keberhasilan operasi tidak semata ditentukan oleh teknologi, tetapi juga oleh kolaborasi lintas fungsi, kepemimpinan adaptif, serta integrasi antara strategi korporat dan kondisi operasional di lapangan. Penerapan SSM membantu EMP merumuskan kerangka kerja koordinatif yang lebih efisien, responsif, dan selaras dengan tujuan produksi jangka panjang.
Kata Kunci: *lapangan minyak berat, Huff and Puff, Soft Systems Methodology (SSM), pengambilan keputusan manajerial, kolaborasi lintas fungsi.*

INTRODUCTION

The oil and gas industry is a highly complex and dynamic sector, which demands cross-functional collaboration between technical, managerial, and operational expertise to ensure production continuity and long-term business success (Bento, 2018). In this context, heavy oilfield development projects such as Huff and Puff (H&P) cyclic steam injection present its own challenges as it involves many stakeholders with diverse interests, resources, and orientations. Without solid synergy between engineering, operations, finance, and management teams, project success is difficult to achieve.

Today, project management practices in the energy sector have shifted from a silo approach to more integrated cross-departmental cooperation. Organizations in the oil and gas industry, including in Indonesia, now view collaboration as one of the

core competencies to increase efficiency, innovation, and competitiveness. However, in its operational reality, the implementation of reservoir development projects is still often carried out separately and fragmented. This reinforces the argument that the integration of technical and managerial decision-making is a key factor in achieving operational excellence (Raisch & Birkinshaw, 2008).

In the Batang Field, which is managed by PT EMP Energi Gandewa (EEG), a subsidiary of Energi Mega Persada Tbk (EMP), Huff and Puff technology has been adopted as a strategy to increase heavy oil production. Although technically this method has proven to be effective (Xu et al., 2013), its implementation is often faced with operational coordination challenges, limited human resources, logistical constraints, and insynchronization between functions. The EEG's relatively new organizational structure and still dominated by technical personnel without clear managerial communication channels complicates collective decision-making.

Preliminary studies show that the main obstacle in the implementation of the Huff and Puff project lies not in its engineering methods, but in systemic weaknesses in coordination and communication between stakeholders. This includes unintegrated planning, the absence of agreed performance indicators, and non-optimal workflows between work units. Under these conditions, conventional analytical approaches are not enough to comprehend the dynamics of the problem as a whole. Therefore, a systemic approach is needed that is able to accommodate technical, managerial, and social aspects at the same time.

Soft Systems Methodology (SSM) is present as a relevant approach because it is able to deal with complex and human-oriented problems (Checkland, 1981). SSM emphasizes the importance of understanding reality from the perspective of various stakeholders, and allowing the identification of consensus-based solutions that are technically and operationally feasible. In the context of EEG, the implementation of SSM has the potential to uncover the root of the hidden problems in the Huff and Puff implementation process as well as design systemic improvements oriented towards production sustainability.

EMP as the parent company has the responsibility to ensure that each of its subsidiaries, including EEG, is able to operate efficiently, safely, and profitably. EEG itself was mandated to contain the rate of decline in production in the Batang Field, Riau, through the steam injection method. However, coordination challenges, technical uncertainty, and unstable organizational structures have the potential to hinder the achievement of these goals. Therefore, there needs to be an in-depth study of the entire operational and managerial system in the field.

Through the implementation of SSM, this research will map the problem situation, identify stakeholders, explore the root causes of implementation challenges, and design strategic recommendations that are able to strengthen synergy between work units, increase decision-making effectiveness, and ensure the successful implementation of the Huff and Puff program. This study uses *Soft Systems Methodology* (SSM) as a managerial approach to analyze organizational dynamics and identify root causes from the perspectives of various stakeholders in the implementation of the Huff and Puff steam injection project in the Batang Field.

RESEARCH METHODS

Data Collection

The data collection process is a crucial step in obtaining relevant empirical information to answer research questions, formulate solutions, and test hypotheses (Tashakkori & Teddlie, 2020; Mwita, 2022). According to Sylvia (2023), data collection methods are divided into two main categories: primary data and secondary data. Primary data is information collected directly from original sources for specific research purposes. Some commonly used methods include experiments, observations, and structured and unstructured interviews (Kempf Leonard, 2005). In this study, primary data was obtained through open-ended interviews with flexible questions, allowing researchers to explore the topic more deeply based on the direction of the discussion. Information is collected from key stakeholders such as petroleum engineering managers, field operators, reservoir engineers, service company representatives, procurement staff, and financial specialists. Direct observation in the field and in-depth discussions are also used to explore the root of the problem thoroughly. Secondary data, according to Martins et al. (2018), refers to data collected by other parties and not specifically for this study. In the context of this study, secondary data was obtained through a comprehensive literature review and analysis of the company's internal documents, including operational reports and standard procedures (SOPs).

Selection of Existing Methodologies and Tools

This study uses a qualitative approach to analyze the dynamics of collaboration in a multi-stakeholder environment. This approach was chosen because of its ability to capture complex interactions, decision-making processes, and operational problems that are difficult to quantitatively measure. Based on the characteristics of the problem, the combination of *Action Research* and *Soft Systems Methodology* is considered the most appropriate because it is able to handle complex real conditions and involves many parties. The qualitative approach or *mixed-methods* is considered the most relevant in

uncovering the social, strategic, and operational dimensions of collaboration in the Huff and Puff project.

Marginal Contribution and Modification of Selected Methodology

This research contributes through the direct application of *the Action Research* and *Soft Systems Methodology* approach in the context of oil and gas projects. Unlike previous studies that have more often used this approach in general organizational contexts, this study adapts the methodological framework for a technical context fraught with engineering and operational challenges. The study also developed a conceptual framework tailored to the specific context of the Huff and Puff project, which includes three key aspects: operational performance, cost efficiency, and financial sustainability and strategic alignment. Figure 1 shows the research design structure used in this study, which consists of the following stages:

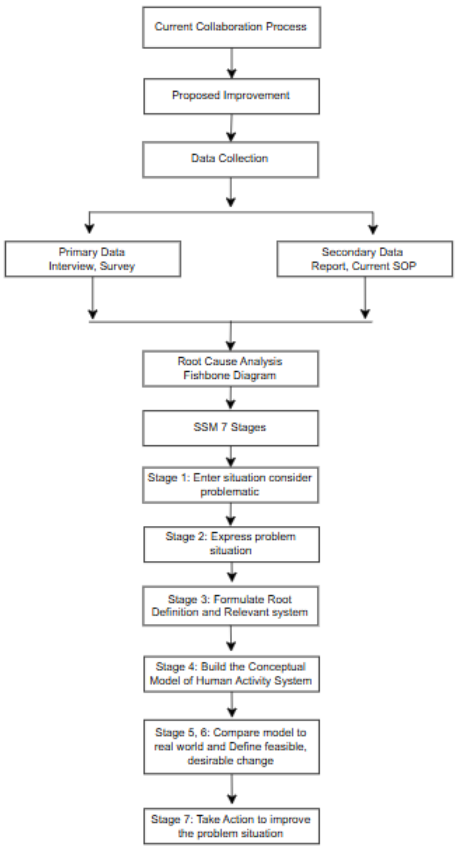

Figure 1. Research Design

Explanation of the research design:

a. Identify the current state of collaboration and desired improvements: The initial stage is carried out by observing existing communication and coordination patterns, and identifying their shortcomings.
b. Data Collection: Data is obtained from primary sources (interviews, observations) and secondary sources (internal reports and company SOPs).
c. Root of the problem analysis using the Fishbone (Ishikawa) diagram: To identify the main cause of coordination problems, by grouping factors into categories such as equipment, people, management, and processes.
d. Implementation of Soft Systems Methodology (SSM): It consists of seven stages ranging from understanding the problem to implementing a feasible and desired solution.
e. Use of Action Research in the context of SSM: This combination ensures that solutions are practical, not merely theoretical, through cycles of diagnosis, planning, implementation, observation, and reflection (Susman & Evered, 1978).

RESULTS AND DISCUSSIONS

Result

Analysis

This research uses *Soft Systems Methodology* (SSM) as a conceptual framework to identify and handle the company's business problems, as well as provide recommendations to improve work patterns between stakeholders in complex situations involving various parties. Primary data were collected through interviews, discussions, and questionnaires of respondents directly involved in the Huff and Puff project. Data analysis was carried out qualitatively to gain a deep understanding of the perspectives of stakeholders. In addition, quantitative data is also collected to support and reinforce these qualitative findings. Quantitative data in the form of performance graphs and closed-ended questionnaires can be used to strengthen arguments, provide additional insights, or confirm qualitative findings.

Interviews are semi-structured, allowing for flexibility in information mining without deviating from key themes such as cooperation and project coordination. The respondents consisted of two management representatives and five people from different divisions or departments who contributed to the Huff and Puff project. All interviews were recorded, transcribed, and summarized in written form. The aim of this research is to contribute to the development of new knowledge and bridge the existing knowledge gap related to collaborative processes in a multi-stakeholder environment. Using seven stages in *SSM-based Action Research*, this research aims to strengthen cooperative relationships between key stakeholders, such as engineering groups, field operations, procurement, finance, and management.

This systematic approach is expected to produce real improvements to coordination between stakeholders, especially in answering the two

research questions that have been raised in the introduction. Information on the implementation of the seven stages of SSM and *Action Research* is presented in Table 1, which illustrates the contribution of each stage to the dynamics of collaboration and decision-making processes.

Table 1. Seven stages of SSM, data collection and processing method

SM Stages	Data Collection	Interviewees	Data Processing	Outcomes
Stage 1: Finding out about a problem situation Understand the current state of Huff & Puff operations, including existing coordination challenges and improvement opportunities across departments.	Review of operational data, planning documents, and field performance reports	Operators, engineers, management	Identification of real-world coordination issues across stakeholders	Defined real problem situation (refer to Fig. 1; Table 2)
Stage 2: Expressing the problem situation Develop a rich picture to visualize diverse perspectives and key relationship dynamics among Engineering, WS, Procurement, and Finance.	Literature study, formal/informal discussions, and in-depth interviews	Operators, engineers, management	Analysis of the problem across key actors (Subsurface, Field, WS, Service Company)	Structured problem representation via rich picture
Stage 3: Formulating root definitions of relevant systems Define the core purpose of Huff & Puff processes from different stakeholder views (e.g., safety, cost control, production targets).	Formal and informal discussions using PQR and CATWOE	production team, finance analyst, procurement	Root definition formulation using PQR and CATWOE tools	Generic purposeful activity model for coordination in Huff & Puff projects
Stage 4: Developing conceptual models Create models to represent key activities, interactions, and decision flows aligned with the five dimensions of collaboration.	Formal and informal discussions	Operators, engineers, management	Constructed five subsystems (governance, administration, autonomy, mutuality, norms) to reflect collaboration dynamics	Integrated purposeful activity model
Stage 5: Comparing conceptual models with the real world Compare models with actual operations to identify coordination gaps and improvement areas.	Formal/informal discussions and document reviews	Operators, engineers, management	Gap analysis between conceptual model and field execution for validation	Accommodation of different stakeholder perspectives and identification of misalignments
Stage 6: Defining feasible and desirable changes				

Identify practical and stakeholder-approved improvements, including better processes, shared KPIs, and communication routines.	Formal/informal discussions and literature studies	Operators, engineers, management	Synthesized findings from Stages 1–5 to define proposed improvement actions	Standardized Huff & Puff coordination process and action list for feasible improvements
Stage 7: Taking action to improve the problem situation Implement the agreed changes and monitor outcomes through experimental learning and continuous feedback.	Formal/informal discussions and meetings	Operators, engineers, management	Action-based reflection and evaluation of impact	Improved coordination practices and residual issues for future refinement

Penerapan Soft Systems Methodology (SSM)

Stage 1: Identify Real-World Problem Situations

The first stage of SSM focuses on an introduction to real problem situations, taking into account the complexity inherent in them. This stage involves gathering the perspectives of various stakeholders, an introduction to potential conflicts of interest, and an analysis of structural barriers that hinder effective collaboration.

In 2024, the transition team will take over the management of the Siak Block from PHE to EEG. This shift brought significant organizational changes, where new teams had to build an operational framework from scratch (see Table 2). However, the transition process was marked by leadership vacancies and structural inefficiencies, as the initial organization was formed with a lean team of personnel temporarily assigned from other business units. This structure does allow for the initial continuation of operations, but it creates challenges in coordination and decision-making, particularly in complex technical projects such as Huff and Puff (H&P).

Table 2. The company and Project in a real-world situation

The Challenges of Collaboration in the Huff and Puff Project

When EEG began to run H&P operations, the absence of a structured collaboration mechanism was immediately identified as a major obstacle to efficiency. H&P is a technical process that requires close coordination between subsurface engineers, field operations teams, procurement, and management to run the steam injection cycle optimally. However, the transition to EEG management has exposed a number of operational inconsistencies, such as unclear decision-making pathways, inconsistent interdepartmental communication, and delays in the procurement of the resources required for well interventions.

The engineering team, which is responsible for well selection, steam injection optimization, and performance monitoring, faces obstacles in obtaining real-time operational feedback from the field due to inefficiencies in reporting and data sharing systems. Field operations teams that run injection and production also experience less frequent but impactful delays, especially when technical programs have not been approved or budget allocations have not been approved. At the managerial level, concerns related to cost efficiency and budget constraints create conflicting priorities between operational feasibility and financial oversight, further complicating collaboration.

Furthermore, because EEG does not have in-house experience in running H&P operations, there are no internal benchmarks that can be used as a reference. As a result, teams often rely on external references or trial and error approaches, leading to inconsistencies in implementation and uncertainty in best practices. Without a structured knowledge-sharing system, valuable insights from the initial H&P cycle are not well documented, making it difficult to evaluate and improve in the future.

Over time, these challenges create a fragmented and stressful work environment, impacting operational efficiency as well as strategic decision-making. The absence of a collaborative framework makes it difficult for stakeholders to align their goals, leading to project delays, waste of resources, and inconsistent communication between departments. These inefficiencies also lead to missed production targets and difficulties in optimizing well performance, which ultimately worsens the relationship between engineering, operations, and management teams.

Expressing Problem Situations

Coordination issues in H&P projects must be understood in the context of the overall EEG organizational transition. As a new entity that has only been in operation for one year, many of the structures, processes, and operational frameworks within EEG are still in the formation stage. This raises a number of key challenges: the organization does not have experience managing H&P projects, does not have internal benchmarks or best practices, limited human resources, and is still in the process of navigating coordination between internal stakeholders.

The absence of standardized workflows, historical references, and structured collaboration mechanisms makes each team – engineering, field operations, procurement, and management – work in silos, prioritizing their respective goals without a shared strategic alignment. The engineering team focuses on well performance, field operations handle day-to-day implementation challenges, procurement faces supply chain uncertainty, and management focuses on cost control and regulatory compliance. However, without a shared framework for decision-making, these groups tend to run independently, leading to mismatches and delays in responding to project challenges. Figure 2 shows Thematic map Axial (larger orange nodes) and open (smaller light blue) coding, arrow indicates direction of coding from general theme to specific insight.

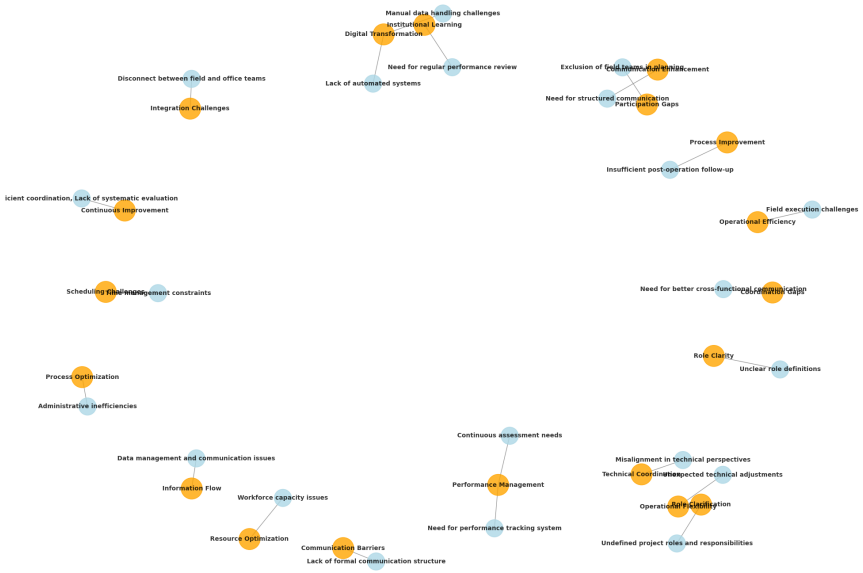

Figure 2. Thematic map Axial (larger orange nodes) and open (smaller light blue) coding, arrow indicates direction of coding from general theme to specific insight.

Field Operations Perspective:

"Sometimes the field is ready for execution, but the engineer's program has not been down, or the budget has not been approved. "*Field Supervisor, Personal Interview, April 13, 2025*. This reflects a common cross-functional coordination challenge, where the readiness of one department is not aligned with the planning schedule or approval of another department. This emphasizes the importance of a shared timeline and integrated planning. Because EEG does not yet have an internal benchmark for H&P operations, decision-making tends to be reactive, not proactive. Teams often work with different assumptions and expectations, creating potential conflicts and inefficiencies. Externally, regulators and stakeholders expect EEG to demonstrate operational capability even though the company is still in the learning phase as the main operator of the H&P project.

To map and explore this complexity, the research uses SSM-based Action Research. This method involves a systematic analysis of

collaboration failures, decision-making paralysis, and stakeholder mismatches. Referring to Checkland et al. (2006), three types of analysis were performed:

a. Analysis I: Identify key actors, their roles, and influences in H&P projects.
b. Analysis II: Exploring the perceptions of each stakeholder towards the challenges faced, as well as the priorities that influence decision-making.
c. Analysis III: Evaluate proposed modifications to strengthen collaboration, establish a knowledge-sharing system, and establish an internal benchmarking process.

A visual representation of the problem situation in the form of *a rich picture* is presented in Figure 3, which maps the relationships between stakeholders, role mismatches, and potential structured interventions. These diagnoses serve as the basis for developing a structured collaboration model that EEG can use to improve the execution of H&P projects and improve future decision-making processes. After open coding is carried out to identify the main issues of the respondent's narrative, the next stage in the data analysis process is axial coding. This stage aims to organize previously acquired codes and group interrelated themes, in order to form an integrated and meaningful analytical framework (Corbin & Strauss, 2008). In the context of the Huff and Puff (H&P) project in EEG, axial coding helps to build a deeper understanding of the root causes of coordination problems, decision-making patterns, and stakeholder relationships.

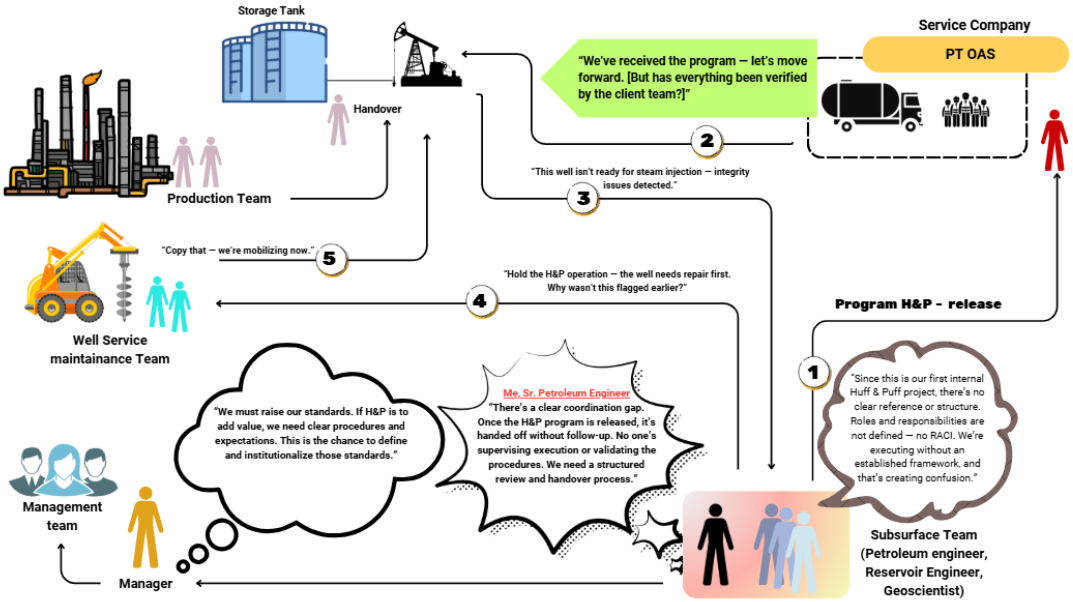

Figure 3. Rich Picture: Coordination Challenges in H&P Project

Some of the main themes that emerged from the axial coding process include: unclear coordination structure, delays in the cross-functional decision-making process, information gaps between teams, and the absence of a structured organizational learning system. For example, the results of the interviews revealed that the parties often do not know who is responsible for coordinating the program, causing an attitude of waiting for each other between divisions (Engineer, interview, April 16, 2025). This is exacerbated by non-uniform informal communication systems, such as the use of WhatsApp applications or emails without standard official information guidance (Support Function Staff, interview, April 12, 2025). Through this grouping of themes, it can be seen that the failure of coordination in the H&P project is not only due to weak communication between individuals, but also due to the lack of organizational mechanisms that support systemic cross-functional collaboration. These findings form the basis for research to design interventions that are not only technical, but also take into account the social-organizational dynamics that affect the success of the project. In the context of SSM, these stages of analysis are the basis for the development of root definitions and conceptual models that can be used as a reference in designing future improvements.

Comparing the Conceptual Model with the Real world

A comparative analysis of the conceptual model and the actual conditions of the implementation of the Huff & Puff project in EEG reveals a number of significant gaps, particularly in the five dimensions of collaboration: governance, administration, organizational autonomy, mutuality, and norms. In the governance dimension, despite the basic framework that has been established, cross-functional coordination practices such as between

engineering, procurement, and finance teams still show weaknesses that cause delays in the provision of materials and services. To overcome this, it is recommended to establish clearer work rules and procedures regarding the limits of decision-making authority as well as a joint tracking mechanism for the procurement and financial approval process to increase transparency and responsiveness. Figure 4 shows Rich Picture shows Comparison of Current and Future Conditions in Huff & Puff Project Coordination.

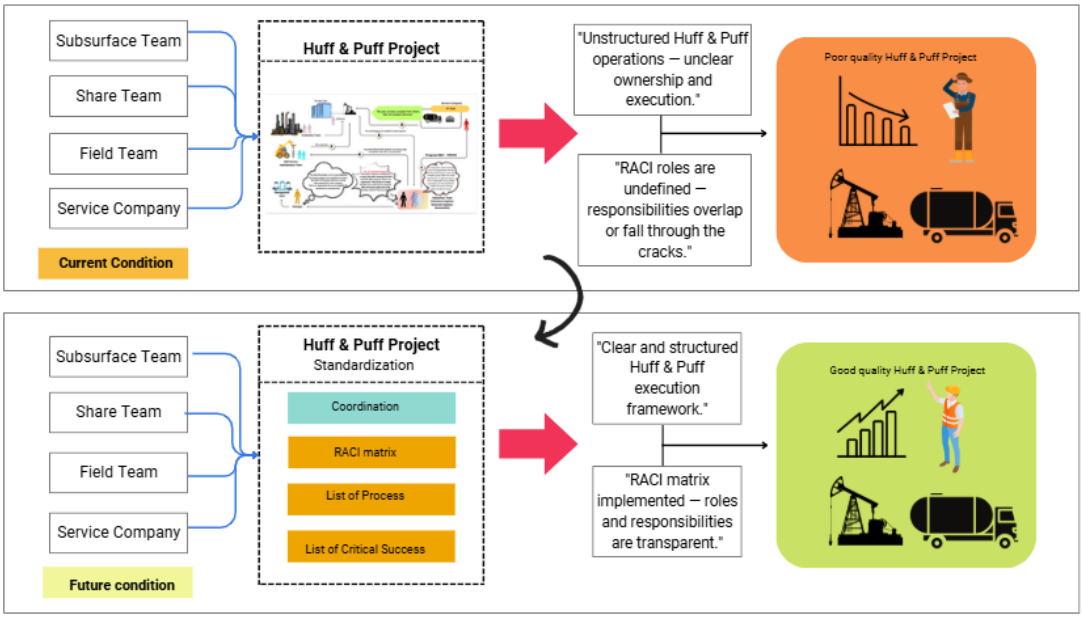

Figure 4. Rich Picture shows Comparison of Current and Future Conditions in Huff & Puff Project Coordination

Meanwhile, in the administrative aspect, the implementation of coordination meetings is still irregular and ad-hoc, without an adequate evaluation system on the performance of project implementation. This has an impact on the lack of continuity of information and slow corrective action. The proposed solution is to schedule regular meetings with a structured agenda as well as develop a system for monitoring and evaluating project performance on a regular basis. In terms of organizational autonomy, it was found that the reporting structure tends to be rigid and centralized, thus limiting the flexibility of the field team in adjusting operations according to dynamic conditions on site. Therefore, it is necessary to delegate limited authority to the field team for technical decision-making within certain limits, accompanied by guidance and supervision from the center. Table 3 shows Comparison Between Real-World and Conceptual Models, Along With Proposed Actions to Bridge the Gap.

Table 3. Comparison Between Real-World and Conceptual Models, Along With Proposed Actions to Bridge the Gap.

Subsystem	Conceptual (Ideal Theory)	Real World Situation	Proposed Action (Business Solution)
Governance	Governance includes working rules, distribution of responsibilities, clear information flow, and role clarity (Bardach, 1998).	The governance structure exists but lacks effectiveness in certain areas. Coordination between functions—such as Engineering, Procurement, and Finance—is weak, especially in providing timely materials/services for Huff and Puff operations. Communication between engineering teams is also fragmented, leading to delays and misunderstandings.	Establish a Huff and Puff Project Charter outlining governance structure, decision rights, and a RACI matrix. Strengthen cross-functional communication through coordination protocols and shared documentation. Assign a single point of contact (PIC) for project-level coordination.

Administration	Administrative subsystem defines coordination mechanisms, reporting procedures, and communication structure (Bardach, 1998).	There is a lack of structured coordination. Meetings are held irregularly or on an ad-hoc basis, and documentation is often disorganized due to limited manpower, as most personnel are focused on operational activities in a lean organizational setup. While Engineering, Well Service (WS), and Finance teams are generally synchronized during planning and execution, there is a lack of alignment and follow-up during the evaluation phase.	Assign a dedicated project administrator. Schedule regular coordination meetings (e.g., weekly). Use shared platforms (Teams/SharePoint) for centralized documentation and progress tracking.
Organizational Autonomy	Effective collaboration respects autonomy while promoting shared responsibility (Thomson et al., 2009; Emerson & Nabatchi, 2015).	Each function tends to pursue its own objectives: Engineering focuses on maximizing production, Finance prioritizes budget discipline, and Procurement emphasizes compliance. There are no shared KPIs to align these goals across functions.	Develop shared KPIs (e.g., end-to-end cycle time). Align goals through cross-functional workshops. Monitor joint performance via a collaborative dashboard.
Mutuality	Collaboration is sustained by interdependence and mutual benefit (Thomson & Perry, 2006).	Stakeholders coordinate fairly well during the preparation phase. However, during execution, communication between Engineering (as project owner) and the Service Company (as executor) remains limited. This is partly due to workload dispersion, as both parties are also engaged in other projects beyond Huff and Puff.	Establish a dedicated coordination focal point or liaison between Engineering and the Service Company specifically for Huff and Puff activities. Implement a shared execution tracker and brief daily check-ins during critical phases to align priorities and resolve issues in real-time. This ensures focused collaboration despite competing workloads and reinforces joint ownership of project success.
Norms (Trust)	Trust and informal norms support long-term collaboration (Ring & Van de Ven, 1994).	Engineering delegates the entire execution to the service company without supervision, as there is no dedicated personnel assigned. The project owner lacks an on-site representative to oversee and coordinate the execution.	Assign a dedicated field representative or liaison from the engineering team to supervise and coordinate with the service company during execution. This representative would act as the project owner's eyes and ears on-site, ensuring that plans are followed, issues are resolved in real-time, and communication between engineering and execution teams remains fluid. If resource constraints exist due to lean staffing, consider a rotational supervision scheme or appointing a cross-functional coordinator shared between projects.

In the mutuality dimension, the low sense of common ownership and collective purpose among departments leads to a weak collaborative spirit. To answer this problem, it is necessary to build a culture of cross-functional collaboration through joint training, project goal alignment

workshops, and team success-based incentives. Finally, in terms of norms, interactions between teams have not been supported by mutually agreed work values, so communication and conflict resolution are often ineffective. Its recommendations for improvement include the development of a teamwork code of ethics and soft skills training to increase empathy, open communication, and appreciation for each party's contributions. By taking into account these five dimensions, this comparison shows that although the conceptual model already describes an ideal collaboration that is systematic and integrated, implementation on the ground still faces structural and cultural barriers that must be addressed strategically in order for the success of the Huff & Puff project to be realized in a sustainable manner.

Discussion

This section reflects on the overall *Soft Systems Methodology* (SSM) process applied in the coordination of the Huff and Puff project in EEG. SSM is not a one-time approach, but rather an iterative learning process that involves various stakeholders in identifying, understanding, and formulating solutions to long-standing systemic problems. This process allows for the alignment of common meaning and structured action planning in the face of project complexity. The process begins with an introduction to complex problem situations, characterized by the fragmentation of coordination between technical, operational, and support functions in the Huff and Puff project. Visualization of complex interactions and stakeholder analysis in the early stages (Stages 1 and 2) resulted in an in-depth understanding of fragmented communication patterns, blurred boundaries of responsibility, and scheduling mismatches between departments.

The next stage (Stages 3 to 5) produces *purposeful activity models* of *root definitions* that reflect the world view of stakeholders. These models are a tool for discussing expected behaviors and functions necessary for effective collaboration. Furthermore, this process helps cross-cultural teams to think prospectively and focus on potential improvements instead of getting stuck in a defensive position. In Phases 6 and 7, the proposed transformation is not top-down, but the result of inclusive negotiations between engineering departments, field operations, service providers, and supporting functions such as Finance and Procurement. The result is contextual solutions such as the designation of coordination points, strengthening execution monitoring, and the development of collaboration tools such as *dashboards* and centralized documentation. This process fosters a sense of shared ownership and opens up space for stronger cross-functional collaboration.

One of the main contributions of this research is the strengthening of structured dialogue as a means of overcoming institutional silos. By providing a systematic space to put forward diverse perspectives, SSM is able to turn conflicts that were initially personal into a common organizational problem. For example, implementation delays that were previously attributed unilaterally to service providers, are understood as the impact of the absence of technical linkages in the field – creating coordination gaps. The cyclical SSM process also provides opportunities for continuous learning. The initial rejection from some parties began to subside as the real benefits of the initial action taken emerged. This confirms that even in challenging situations, small *wins* can build momentum towards broader organizational change.

Implications for Organizational Practices

The findings of this study have several important implications for EEG and similar organizations managing complex projects in the heavy oil sector:

a. Coordination is a capability, not a procedure – Effective collaboration between departments and external contractors relies on investment in structure, roles, and relational dynamics, rather than solely on standard procedures.
b. Informal trusts should be complemented by formal arrangements – Personal networks and experience-based trusts are important, but they cannot replace transparent governance, accountability, and oversight mechanisms.
c. Systemic thinking builds adaptive capacity – The SSM process helps stakeholders understand the interconnectedness of their roles in the broader system, which is important in a multistakeholder environment with often conflicting goals and incentives.
d. Lean teams still need a coordinating framework – Even in organizations with minimal staffing, supervisory structures and coordinating roles are still necessary to avoid fragmentation.

Implications for the Theory

Theoretically, this study enriches the understanding of the application of *Soft Systems Methodology* in the context of collaborative governance in the energy sector. The results of this study show that complex problems in the operational technical environment can be addressed more effectively through a participatory and iterative approach than a top-down command strategy. In addition, this study reinforces the relevance of inter-organizational collaboration theories such as

mutuality, autonomy, and shared governance in field practice.

Business Solutions and Implementation Plans

Departing from the conceptual model and systemic analysis found through the SSM approach, the business solutions offered are holistic and practical. The focus is on strengthening coordination, supervision, and mutual accountability in the Huff and Puff EEG project. This strategy includes:

a. Establishment of a *cross-functional* task force,
b. Use of digital collaboration tools,
c. Integration of shared performance indicators (KPIs),
d. Institutionalization of learning mechanisms through *After-Action Review* and knowledge documentation.

In order for this solution to be implemented sustainably, a phased implementation plan is prepared in four phases: (1) *Alignment and Preparation* to unify understanding and establish a structure, (2) *Pilot Implementation* for pilot project trials, (3) *Evaluation and Refinement* for refinement based on feedback, and (4) *Scaling and Institutionalization* for replication and integration into the organization's overall operations. Each phase is designed to ensure solutions are not only technically effective, but also organizationally and culturally acceptable.

CONCLUSION AND SUGGESTION

This research shows that increased collaboration between key stakeholders in Huff and Puff projects including Engineering, Field Operations, Procurement, Finance, and external partners does not necessarily solve all problems permanently. In the context of complex and dynamic oil and gas operations such as in the EEG, collaboration must be understood as an ever-evolving social process that requires continuous adjustment, learning, and negotiation. The Soft Systems Methodology (SSM-AR)-based Action Research approach has proven to be appropriate for understanding and intervening in unstructured collaborative challenges, particularly due to its ability to accommodate a diversity of perspectives and build solutions that are systemically desirable and culturally acceptable. This study affirms the importance of mutuality as a foundation for collaboration, given that all parties have a common goal to achieve project success. In the context of semi-networked organizations with a high degree of autonomy such as EEG, the most influential dimensions of collaboration are mutuality, shared norms, and autonomy, rather than formal structures such as governance and administration. Therefore, the strategy to strengthen collaboration should start from building mutual understanding, informal trust, and respect for the autonomy of each party, then continue with strengthening the governance system and administrative support. Although the study has limitations in terms of specific corporate and industry contexts, the results make significant theoretical and practical contributions in understanding and managing collaboration in complex work environments.

Based on these findings, it is recommended that the EEG establish a cross-functional forum that is structured as a forum for routine communication and coordination mechanisms between departments, in order to strengthen the alignment of objectives and strengthen working relationships. In addition, it is important for companies to develop a joint project charter template that is signed by all relevant parties at the beginning of the project, as a form of commitment to a clear division of roles and responsibilities. To maintain the sustainability of collaboration, EEG also needs to invest in cross-functional team leadership development and training programs that emphasize empathy, negotiation, and systemic thinking. Furthermore, SSM's proven approach can be integrated into the company's continuous improvement framework, by involving internal facilitators trained in this methodology. As a first step, the implementation of the proposed collaboration framework should be piloted first on small-scale projects to test effectiveness and make refinements before being implemented more widely in subsequent Huff and Puff projects. With these measures, EEG is expected to improve the quality of internal coordination and achieve more effective and sustainable operational outcomes.

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