OPTIMIZING OPERATIONAL MANAGEMENT IN OFFSHORE CRANE SERVICES: A CASE STUDY ON HANDAL ENERGY BERHAD

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Abstract

This case study explores the determining factors affecting the operational management of Handal Energy Berhad (HEB), a leading Malaysian provider of integrated offshore crane services. Utilizing a qualitative methodology grounded in in-depth interviews with 13 key stakeholders including industry experts, government officials, and company executives, the study identifies core operational challenges such as talent shortages, high maintenance costs, logistics constraints, and regulatory compliance issues. Findings are organized thematically and underscore how inefficiencies in crane utilization, market unpredictability, and skill scarcity limit operational performance. The study also evaluates how emerging technologies like predictive maintenance, digital monitoring, and advanced logistics systems can provide viable solutions. With rising infrastructure and offshore energy investments, strategic enhancements in human capital, cost control, and regulatory adherence are crucial. Recommendations include better training pipelines, improved supplier relationships, and investment in Industry 4.0 technologies. This study contributes to both theoretical knowledge and practical applications in offshore engineering and operations management, offering valuable insights for companies navigating similar challenges.

Keywords : Offshore crane services, Operations management, Handal Energy Berhad, Integrated logistics, Maintenance strategy, Talent development

1.1 INTRODUCTION

Handal Energy Berhad (HEB), incorporated in 2011, is a public-listed Malaysian company specializing in integrated offshore pedestal cranes that meet API 2C certification standards. With a core focus on the oil and gas sector, HEB provides mission-critical services such as crane rental, manufacturing, installation, inspection, maintenance, and refurbishment. These services are essential for offshore production platforms, refineries, and marine construction. HEB has evolved into a strategic solutions provider, delivering high-performance, cost-effective, and safe lifting operations through both long-term contracts and on-demand call-out agreements (Handal Energy Berhad, 2022).

The global offshore crane industry is experiencing rapid expansion, driven by increasing infrastructure investment, technological advancements, and rising energy demand (Fortune Business Insights, 2023). As reported by Fortune Business Insights (2020, 2023)**,** the industry is projected to grow at a compound annual growth rate (CAGR) of 4.5%, escalating from USD 36.36 billion in 2021 to nearly USD 50 billion by 2028. This upward trajectory is further supported by Fortune Business Insights (2020), which observed a 2.7% year-on-year growth during the peak of the COVID-19 pandemic—a testament to the sector's resilience.

Despite global gains, Malaysia's offshore crane services sector faces significant challenges. COVID-19 disruptions, oil price volatility, labor shortages, and the rising cost of spare parts have collectively strained business operations. Underscoring the need for market-driven strategies to navigate environmental uncertainties (ElNaggar *et al.,* 2023). HEB, for example, reported a 25% drop in revenue and an 82% increase in administrative and operating expenses in its 2022 financial report. These figures reveal the underlying operational inefficiencies and external market pressures facing even the most established players (HEB Annual Report, 2022).

The industry operates in a capital-intensive environment where cranes are indispensable for offshore oil and gas operations. Cranes support the movement, installation, and repair of heavy-duty equipment and infrastructure, including risers, platforms, and piping. They play a pivotal role in project logistics and are essential for ensuring worksite safety and efficiency. However, the high cost of crane maintenance, combined with fluctuating job requests under call-out contracts, imposes operational unpredictability. In addition, the growing complexity of offshore platforms demands more sophisticated crane capabilities, thereby increasing reliance on specialized human capital and cutting-edge technologies (CIRIA, 2005; BOMAC Altrac, 2005).

Malaysia's crane ecosystem, while technically capable, faces persistent limitations in talent development. Many skilled technicians are approaching retirement age, and there is an insufficient pipeline of new certified operators to replace them (ECITB, 2022). Furthermore, training programs are often fragmented, time-consuming, and misaligned with rapidly evolving industry needs. This contributes to extended project downtimes and safety compliance risks.

From a business standpoint, the fragmented nature of Malaysia's crane rental agreements—predominantly structured as call-out contracts—prevents revenue forecasting and asset optimization. Many of HEB's service contracts in 2022 were renewed, yet lacked firm financial commitments due to the on-demand nature of work assignments. This led to reduced work orders, underutilized assets, and impaired intangible rights. As a result, the company recorded a net loss of RM35.2 million in 2022 despite maintaining a positive operational cash flow of RM78 million (Handal Energy Berhad, 2022).

In addition to internal issues, the broader regulatory and competitive landscape plays a crucial role. Offshore operations are governed by rigorous compliance standards such as API, RP 2D and LOLER, and failure to meet these requirements can lead to operational shutdowns, reputational damage, and financial penalties. The lack of a harmonized safety protocol across Asia further complicates operations, especially when multilingual and multicultural crews are deployed on offshore platforms (Axess Group, 2021; Cranes Today, 2022).

Given these complex challenges, this study aims to critically investigate the determining factors that affect HEB's operational management. The objective is twofold: (1) to identify internal and external operational drivers, and (2) to recommend practical, technology-driven, and human-capital-focused solutions that can improve organizational resilience. This includes assessing workforce capability, service reliability, financial sustainability, and technological readiness.

The research contributes to both practical business strategies and the academic discourse on integrated offshore operations. By integrating stakeholder insights with literature and organizational analysis, the study identifies root causes of inefficiencies, evaluates potential interventions, and proposes a multidimensional operational framework.

The significance of this study lies in its timely and strategic relevance. Offshore energy remains a cornerstone of Malaysia's economic development. As the nation accelerates its push toward sustainability and industrial modernization, enhancing offshore service efficiency is vital. Findings from this study will benefit industry practitioners, policy makers, researchers, and training institutions committed to developing robust and competitive offshore operational systems.

2.0 LITERATURE REVIEW

Operations management is widely regarded as a strategic cornerstone of organizational efficiency, especially in complex, high-risk sectors such as offshore engineering. As defined by Enaohwo (2024), operations management is the science and art of ensuring the optimal use of resources to produce and deliver goods and services efficiently. Within the offshore crane services sector, this includes a dynamic interplay of planning, scheduling, compliance, logistics, cost control, human resources, and stakeholder engagement. The offshore environment is especially unforgiving, demanding precision, safety, and responsiveness. For companies like Handal Energy Berhad (HEB), operational success hinges on not just physical

infrastructure, but also how effectively internal processes, people, and technologies align with external challenges.

This literature review synthesizes existing research and industry reports relevant to the seven core domains affecting offshore crane operations: integrated services, maintenance and safety, human capital, cost control, supply chain, regulatory frameworks, and integrated management. These areas are examined with a focus on their strategic implications for Handal Energy and the Malaysian offshore services sector.

2.1 Workforce Capability

The offshore crane services industry is experiencing significant strain due to critical gaps in workforce capability. As highlighted in the literature, skilled personnel—including crane operators, riggers, safety officers, and maintenance technicians—are in short supply. A major contributing factor is the aging workforce at Handal Energy Berhad (HEB), where more than half of the technical staff are approaching retirement (Handal Energy Berhad, 2022). Compounding the issue is the limited inflow of new talent, attributed to high certification costs, limited vocational training infrastructure, and negative industry perceptions.

Educational pathways remain fragmented and expensive, with overlapping certifications such as BOSIET and API 2D burdening potential entrants. ECITB (2022) points to institutional shortcomings in delivering industry-aligned technical training, further stalling pipeline development. The COVID-19 pandemic exacerbated these constraints by delaying certification and training schedules. Fragmented training systems and certification delays exacerbate workforce shortages in engineering fields (Olivio & Kafetzopoulos, 2022). The literature calls for a workforce development strategy that includes modular certification, employer-sponsored apprenticeships, and greater collaboration with accredited training institutions to rebuild technical competency pipelines.

Integrated management perspectives further argue that workforce capability does not exist in isolation but impacts operational safety, productivity, and financial outcomes. Therefore, investments in human capital development are not only necessary but strategic.

2.2 Service Reliability

Service reliability is paramount in offshore operations, particularly in crane-related activities where safety, precision, and compliance are non-negotiable. Cranes in marine environments are subjected to corrosive conditions and high operational stress, necessitating rigorous inspection and maintenance regimes. While industry standards such as API RP 2D and ISO 12482 provide maintenance protocols, the literature identifies recurring issues in execution—ranging from inadequate inspections to post-repair lapses (Faten Adilah, 2010). These issues directly compromise crane reliability, increase safety risks, and delay project delivery.

Despite the global shift toward predictive maintenance technologies, adoption in Malaysia remains limited, despite growing global momentum (Fortune Business Insights, 2023). Most of HEB's cranes are still maintained using manual schedules, reflecting an overreliance on preventive rather than predictive maintenance. This affects asset uptime and project performance. The deployment of remote monitoring systems, automated diagnostics, and AI-driven failure prediction models is proposed as a viable route toward enhancing service reliability. These innovations reduce unplanned downtime and improve operational continuity—key metrics in client satisfaction and contract performance (Zhao & Chen, 2021).

Additionally, logistics bottlenecks, such as supply chain disruptions, weather impacts, and customs clearance, continue to challenge services reliability in Malaysia's offshore industry (Bernama Energy, 2024). Firms that leverage decentralized logistics hubs and digital scheduling tools, as demonstrated by industry leaders like Thunder Cranes, are better positioned to offer responsive and uninterrupted services (Thunder Cranes Sdn Bhd, 2023; Offshore Engineer Magazine, 2022).

2.3 Financial Sustainability

Financial resilience is a recurring theme across the literature, particularly in the face of market volatility, fluctuating oil prices, and unpredictable call-out contract models. Offshore service firms like HEB face an operational paradox: they must maintain readiness for high-value, short-notice projects without the assurance of consistent revenue. This exposure results in unstable cash flows and increased vulnerability to cost overruns and impairments.

HEB's 2022 financial results, which reported a RM35.2 million net loss despite RM78 million in revenue, underscore the scale of this challenge. The losses were attributed to project delays, administrative overheads, and unabsorbed costs tied to client-driven scheduling. The literature points toward agile financial systems as a solution, advocating for real-time budgeting, scenario-based forecasting, and operational expenditure monitoring linked to specific project KPIs (Wang & Fang, 2012, 2022). Agile financial management systems allow offshore firms to remain resilient despite volatile market conditions (Wang & Fang, 2022).

Furthermore, aligning financial discipline with integrated cost management—across procurement, HR, and maintenance—enhances long-term sustainability. HEB's internal cost management framework, which includes six pillars from budgeting to compliance oversight, provides a strategic model that should be enforced through cross-functional accountability and data-driven performance reviews.

2.4 Technological Readiness

Technological readiness represents both a challenge and an opportunity for transformation in offshore crane services. While the sector is beginning to adopt digital tools such as IoT-based asset tracking, AI diagnostics, and cloud-based

logistics platforms, the pace of adoption in Malaysia is notably slower compared to global counterparts. This digital lag is particularly evident in maintenance regimes, where manual inspections and reactive repairs remain the norm despite available alternatives. Technological readiness now includes compliance automation and remote monitoring for offshore cranes (Axess Group, 2021).

The literature supports a shift toward digital integration across core operational processes. Predictive maintenance tools, telemetry-based monitoring systems, and compliance automation platforms are cited as critical enablers of performance reliability and operational efficiency. However, digitalization remains uneven in offshore services, hindered by barriers such as high initial investment, limited technical literacy, and resistance to change persist, especially among aging technical staff (Kim & Park, 2023).

From a compliance perspective, digital readiness also includes the adoption of automated regulatory checklists, multilingual e-learning modules, and standardized audit trails. These tools can improve adherence to regulatory requirements set by DOSH, PETRONAS, and international frameworks like API 2C. In addition, digital logistics and project management platforms are proposed as solutions to coordination failures between service providers and clients—failures that often result in costly offshore delays and resource underutilization.

The integration of these technologies must, however, be matched by change management programs, reskilling efforts, and system-wide readiness assessments. As noted in the integrated management system literature, technology adoption without cultural and procedural alignment risks fragmentation and underperformance.

3.0 RESEARCH DESIGN AND METHODOLOGY

The research design and methodology adopted in this study serve as the backbone for uncovering the multifaceted operational challenges faced by Handal Energy Berhad (HEB) in the integrated offshore crane services sector. Recognizing the complexity and specificity of the offshore engineering environment, this study embraced a qualitative research design, rooted in the interpretivist paradigm, to explore subjective realities, contextual nuances, and the lived experiences of industry stakeholders.

Qualitative research was selected due to its ability to extract rich, in-depth insights that quantitative methods may overlook, particularly in environments characterized by technical intricacy, safety sensitivity, and unpredictable demand fluctuations. This methodological choice was aligned with the need to capture diverse stakeholder perspectives on operational, financial, and regulatory dynamics within Malaysia’s offshore crane industry.

3.1 Research Paradigm and Approach

The study was conducted under the interpretivist paradigm, which assumes that reality is socially constructed and context-dependent. As such, it emphasizes the value of understanding phenomena from the perspectives of those experiencing them, consistent with the guidance of Saunders *et al.* (2023). The interpretivist approach

was deemed particularly appropriate for examining the unique interplay between logistics, safety, compliance, and resource management in the Malaysian offshore oil and gas context.

A case study method was selected to provide a holistic view of HEB's operations. This approach enabled an in-depth, context-rich exploration of HEB's internal processes and stakeholder engagements, thereby allowing for the emergence of patterns and themes that quantitative techniques may have missed. It also supported the integration of various data sources, including interviews, company reports, and field observations, thus promoting triangulation and credibility of the findings.

3.2 Participant Profile and Sampling Strategy

A purposive sampling strategy was used to select 13 key informants who held critical roles within or adjacent to the offshore crane ecosystem. These included senior management personnel from HEB, clients, government regulators, offshore project owners, engineers, and suppliers. Informants were chosen for their knowledge, direct involvement, and decision-making capacity in the integrated crane services value chain. The demographic profiles of these participants varied across age, profession, and years of industry experience, enhancing the representativeness and richness of the data collected. Detailed distributions of gender, educational background, religious belief, and occupational roles were documented and presented in Tables 4.1.

3.3 Data Collection Process

The primary method of data collection was in-depth semi-structured interviews, conducted over several months in 2023. This format allowed for flexibility in exploring emergent issues while ensuring alignment with the research objectives. Interview questions were derived from the questions and were categorized by thematic focus in operational management.

Interviews were held in both virtual and physical settings, depending on participant availability and preference. Interviews were audio recorded (with consent), and comprehensive notes were taken using mnemonic writing techniques. Where possible, informal observations and off-record comments were also noted to enrich contextual understanding.

To supplement and validate primary data, secondary sources such as HEB annual reports, training documentation, market reports, and regulatory publications were reviewed. This triangulation helped to cross-verify participant responses and provide a grounded framework for analysis.

3.4 Ethical Considerations

Ethical approval was secured prior to fieldwork, and all participants were fully briefed on the objectives, risks, and data protection measures involved. Informed consent was obtained from each participant, who was also assured of anonymity,

voluntary participation, and the option to withdraw at any stage. Identifying details were removed from the final transcripts to protect privacy, and data was stored securely to prevent unauthorized access. Participants were also provided with the opportunity to review their interview transcripts for validation—an important step to enhance the credibility and trustworthiness of the findings.

3.5 Interview Design and Execution

Interview guides were carefully crafted for each stakeholder group. For example, specific question sets were developed for top management, field engineers, suppliers, and clients as shown in Tables 3.1 These guides covered key topics such as resource scheduling, project delays, safety enforcement, talent management, cost control, and technology adoption.

A total of 13 interviews were completed, with participant selection and scheduling facilitated through a combination of internal HEB contacts and snowball referrals. A structured recruitment strategy ensured that the informants represented a cross-section of operational perspectives. All sessions were transcribed verbatim and coded for thematic analysis.

Table 3.1 Interview guide for director, top management, authority, suppliers and agent of Handal Energy Bhd

Question	Purpose
Topic 1: Role of (HANDAL ENERGY BHD) in Supplying Integrated Crane in Malaysia	
"In your opinion, what is the role of (HANDAL ENERGY BHD) as integrated crane business provider in Malaysia?"	Engagement question: To understand current happenings
"Is (HANDAL ENERGY BHD) involved in policymaking for integrated crane business in Malaysia?"	Exploration question: To assess current happenings
"Who are the members of integrated crane provider?	Exploration question: To assess current happenings
"Are the roles of (HANDAL ENERGY BHD) as provider clearly defined?"	Exploration question: To assess current happenings
Topic 2: Limitations or Challenges Faced by (HANDAL ENERGY BHD)	
"What do you think of integrated crane business as offshore crane provider medium?"	Exploration question: To assess current happenings
"What do you think of integrated crane business in Malaysia?"	Exploration question: To assess current happenings
"What are the current happenings of the integrated crane business in Malaysia?"	Exploration question: To assess current happenings
"What would the future hold for integrated crane business in Malaysia?"	Exploration question: To assess future happenings
Topic 3: Effectiveness of Current Integrated Crane Supplier Measurement in Malaysia	

"How effective are the integrated crane business measurement in the Malaysian market?"	Exploration question: To assess current integrated crane market measurement model
"How do you think integrated crane business measurement as integrated crane business provider in Malaysia?"	Exploration question: To assess current happenings
"What is the current integrated crane business measurement (report) you get from the government?"	Exploration question: To assess current happenings
"As a provider, what other measurements integrated crane business supplier that you hope to obtain?"	Exploration question: To assess current happenings
"How do you think integrated crane business measurement can be"	Exploration question: To assess current happenings
"Apart from Reach and Frequency, my current readings have suggested that price of integrated crane, size of, competitor, importers and ROI be included for an effective integrated crane provider measurement. In your experience, what are the variables that should or should not be included in the integrated crane business measurement? Why?"	Exploration question: To assess current measurement
Topic 4: Recommendations and Solutions for Integrated Crane Business Measurement in Malaysia	
"How do you think the challenges of integrated crane production and supply measurement can be solved in Malaysia?"	Exploration question: To assess current happenings
"Way forward, what are your recommendations for integrated crane supplier as crane provider in Malaysia?"	Exploration question: To assess current happenings
Exit Questions	
"Do you have anything else to add on in terms of integrated crane supplying measurement?"	Exit question: To review overall focus group discussion and purpose
"From the brief summary, have we missed anything else?"	Exit question: To acknowledge completion

3.6 Data Analysis and Coding

The data analysis phase of this research employed a thematic analysis approach, following the framework described by Braun and Clarke (2022), which chosen for its flexibility and strength in identifying, analyzing, and reporting patterns within qualitative data. Specifically, the analysis followed the six-phase framework developed by Braun and Clarke (2006), which provided a structured, rigorous method for making sense of the diverse and nuanced insights gathered during interviews.

The process began with an intensive familiarization stage, where the researcher immersed themselves in the raw data by listening to recorded interviews multiple times and reading through each transcript repeatedly. This immersion enabled the researcher to develop a strong contextual understanding of the interview content and to begin identifying preliminary patterns in the responses. Field notes and

observational memos taken during and after the interviews were also reviewed at this stage, helping to shape initial interpretations.

Next, the data was subjected **to** initial coding**,** where meaningful units of information were labeled using NVivo software. Coding was both inductive and deductive—some codes emerged directly from the participants' language (data-driven), while others were informed by the research objectives and theoretical constructs discussed in the literature review (concept-driven). This dual coding approach allowed for the simultaneous emergence of grounded themes and the exploration of predefined operational areas such as workforce challenges, maintenance strategy, financial control, logistics, and compliance.

Following coding, the third phase involved searching for themes by clustering similar codes into broader categories. This was done systematically by grouping the coded data into potential themes that addressed the research questions. The emerging themes were then mapped using Attride-Stirling's (2001) thematic network analysis framework**,** which organizes qualitative data into three levels of thematic abstraction: basic themes (specific issues), organizing themes (mid-level patterns), and global themes (overarching narratives). This multi-tiered model helped to visualize and interpret the relationships between operational elements within HEB's integrated crane system.

The fourth phase involved reviewing and refining the themes to ensure internal coherence and distinctiveness. At this point, the themes were checked against both the coded extracts and the entire data set to confirm that they accurately represented the content and were supported by sufficient evidence. Some themes were merged, split, or redefined during this iterative process to reflect the complexity and interdependence of the issues identified. For example, themes initially labeled "scheduling inefficiency" and "contract unpredictability" were consolidated under the organizing theme "contractual constraints."

In the fifth phase, the finalized themes were defined and named, capturing their essence in a concise and analytical manner. Each theme was written up with a definition, supported by representative quotations from participants to illustrate the points being made. This helped to establish authenticity and demonstrate that the interpretations were rooted in the actual voices of the stakeholders.

Finally, in the reporting phase**,** the results of the thematic analysis were structured into a coherent narrative that forms the foundation of Chapter 4 (Results and Discussion). Visualizations, including thematic networks and matrices, were created to show how the different themes interacted and where they overlapped. These visual tools helped to articulate the interconnectedness between global themes—such as operational performance and compliance—and more granular topics like communication breakdowns or equipment reliability.

Throughout the analysis, great care was taken to maintain transparency, consistency, and traceability in the research process. Coding logs, memos, and NVivo outputs were archived to serve as an audit trail, allowing for methodological reproducibility and external verification. This comprehensive and reflexive analytical approach ensured that the findings were not only credible but also capable of

supporting practical and strategic recommendations for improving offshore crane operations at Handal Energy Berhad.

3.7 Ensuring Reliability, Validity, and Objectivity

To establish validity, the study applied triangulation by cross-referencing interview data with document reviews and field observations. Member checks were also used, allowing participants to validate the accuracy of their transcribed responses. Reliability was supported by maintaining a comprehensive audit trail of coding decisions, methodological choices, and researcher memos. Peer reviews and feedback sessions were held with academic supervisors and industry practitioners to ensure objectivity. The research achieved theoretical saturation by the 12th interview, with no new themes emerging—indicating data adequacy and completeness.

4.0 FINDINGS AND DISCUSSION

This section presents the findings of the study based on a qualitative analysis of interviews conducted with 13 key stakeholders involved in the offshore integrated crane operations of Handal Energy Berhad (HEB). The discussion is structured around eight major thematic areas derived from a rigorous thematic analysis using the Attride-Stirling framework (2001), as visualized in Figure 4.2. These themes illuminate the most critical determinants affecting HEB's operational management and are interpreted through both a practical and strategic lens.

The results clearly demonstrate that operational management challenges at HEB are systemic, interconnected, and embedded in both internal organizational practices and external market conditions. Each theme is presented with illustrative insights from the field and is followed by a reflection on its strategic implications for HEB's competitiveness, sustainability, and growth.

4.1 Descriptive Findings

This study draws from in-depth qualitative interviews with thirteen informants affiliated with HANDAL ENERGY BHD—comprising a mix of management personnel, suppliers, and customers. Their demographic, socio-economic, and professional backgrounds provide essential context for understanding the human dimensions influencing integrated offshore crane operations.

Table 4.1 : Descriptive Analysis of the Informants

Category	Sub-category	Frequency	Percentage (%)
Gender	Male	8	61.5%
	Female	5	38.5%
Age Group	20–29 years	1	7.7%
	30–39 years	2	15.4%
	40–49 years	4	30.8%
	50–59 years	4	30.8%
	60 years and above	2	15.4%
Marital Status	Married	10	76.9%

	Single / Divorced / Separated	3	23.1%
Educational Background	Primary School	1	7.7%
	Secondary School	3	23.1%
	Tertiary Education (Diploma/Degree)	9	69.2%
Religion	Muslim	10	76.9%
	Christian	1	7.7%
	Hindu	1	7.7%
	Buddhist	1	7.7%
Occupation	White-Collar (Manager/Officer/Clerical)	6	46.1%
	Government Sector	2	15.4%
	Self-Employed	2	15.4%
	Blue-Collar (Technicians/Operators)	1	7.7%
	Others (e.g., Homemaker)	2	15.4%

4.2 Thematic Analysis

To systematically analyze and present the qualitative insights gathered for this study, the thematic network approach proposed by Attride-Stirling (2001) was employed. This method structures qualitative data into three hierarchical levels: basic themes, which capture specific issues identified in the data; organizing themes, which group related basic themes into broader categories; and a global theme that encapsulates the overarching narrative emerging from the findings. This structured network provides a clear, visual, and interpretive framework, allowing complex qualitative data to be distilled into coherent thematic patterns (Figure 4.2).



Figure 4.2 : Thematic Network Model by Attride-Stirling (2001)

The following sections elaborate on each of the basic themes identified, organized under their respective thematic categories to highlight the key operational challenges and strategic imperatives facing by Handal Energy Berhad.

Workforce Capability

A critical challenge confronting HEB lies in its aging and contracting technical workforce. Over 50% of crane operators and maintenance personnel are approaching retirement age, while younger entrants remain scarce due to the hazardous reputation of offshore work, limited career mobility, and burdensome certification costs. Furthermore, training pathways are inconsistent across institutions, leading to gaps in practical competency despite formal qualifications.

To ensure workforce renewal, HEB should invest in structured talent development strategies. These could include the creation of an internal training academy, competency-based certification co-developed with Technical and Vocational Education and Training (TVET) providers, and implementation of apprenticeship models that not only attract talent but ensure standardized skills development. These approaches would strengthen long-term workforce capability and reduce operational dependency on a shrinking labor pool.

Additionally, cross-functional awareness is essential where poor workforce capability directly affects maintenance performance and safety adherence, emphasizing the need for holistic HR planning embedded within broader operational strategies.

Service Reliability

Service reliability in HEB's offshore operations is significantly compromised by two primary factors: maintenance inefficiencies and logistical breakdowns. Maintenance practices remain largely preventive and reactive, constrained by limited access to real-time diagnostics and slow procurement cycles. As a result, delayed part replacements and equipment fatigue contribute to unscheduled downtimes and project interruptions.

Similarly, logistical constraints—including customs delays, limited offshore inventory, and coordination failures—result in frequent job postponements. These inefficiencies increase standby costs and erode client confidence. HEB's reliance on call-out contracts further complicates scheduling and resource mobilization, reinforcing a cycle of reactive operations.

Improving service reliability requires strategic transitions on multiple fronts. First, predictive maintenance technologies such as IoT-enabled condition monitoring, mobile diagnostic apps, and AI-based fault prediction must be integrated. Second, logistics performance can be enhanced through vendor-managed inventory systems, offshore logistics dashboards, and AI-driven demand forecasting tools. Finally, establishing longer-term service-level agreements (SLAs) with clients would allow for more predictable scheduling, reducing idle capacity and enabling proactive planning.

Financial Sustainability

HEB faces acute financial stress, as evidenced by its RM35 million net loss in 2022, despite healthy operational revenues. This financial instability stems from unpredictable contract income, administrative inefficiencies, and underutilized assets. Interviewees emphasized that reactive budgeting, driven by volatile project demands, and lack of scenario forecasting undermine effective financial planning.

To strengthen financial sustainability, HEB must shift from cost control to value creation. This includes re-engineering its revenue model by offering digital consulting, analytics services, or subscription-based maintenance packages. In parallel, operational costs must be governed by project-based financial KPIs and real-time expense dashboards, enabling better capital allocation and faster financial responses to shifting conditions.

Moreover, stabilizing revenue through well-structured SLAs will support not only financial resilience but also investment planning in areas like workforce development and digital transformation—demonstrating the interdependence between financial health and other operational domains.

Technological Readiness

Digital maturity remains a significant weakness within HEB. Despite limited use of CMMS and basic automation tools, most departments operate in silos, with minimal cross-functional integration and limited IT leadership. Middle-management resistance and fragmented digital planning further delay adoption of technologies essential for performance optimization.

Key gaps include the absence of predictive maintenance ecosystems, real-time financial monitoring, digital logistics coordination, and compliance automation. Safety performance, too, suffers from poor digitization—manual safety checks and inconsistent enforcement hinder the establishment of a strong safety culture.

To build technological readiness, HEB should develop a coherent digital transformation roadmap. This roadmap must prioritize integration across HR, operations, maintenance, finance, and compliance. The use of user-friendly mobile platforms, multilingual training modules, and automated reporting tools would improve operational consistency and regulatory adherence. Strategic partnerships with tech providers could accelerate system deployment and reduce capital burden. Ultimately, digital transformation is not a stand-alone project but a critical enabler for enhancing workforce effectiveness, service quality, and financial control.

5.0 CONCLUSION AND LIMITATION

This study has provided a comprehensive examination of the critical factors influencing the operational management of Handal Energy Berhad (HEB) within the offshore crane services sector. Through qualitative inquiry, thematic analysis, and stakeholder-focused exploration, the research identified a complex array of

operational inefficiencies and strategic constraints spanning workforce capability, service reliability, financial sustainability, and technological readiness.

These findings confirm that HEB's operational performance is shaped by an intricate interplay of human, structural, and environmental variables. Improving job predictability through effective contract management and enhanced client coordination, alongside upskilling initiatives and modernization of maintenance practices, can substantially increase asset uptime. Moreover, the integration of digital logistics solutions, AI-driven demand forecasting, and decentralized inventory systems presents an opportunity to resolve recurring operational bottlenecks. These insights reinforce prior research (e.g., Wang & Fang, 2012, 2022; Faten Adilah, 2010) that advocate for integrated, agile, and technologically responsive models of operation in volatile industries.

The analysis reveals that HEB's operational challenges are deeply interconnected across the four strategic domains. Workforce constraints weaken maintenance execution; poor logistics disrupt service reliability; financial fragility hinders technological investment; and limited digital tools reduce organizational agility. Addressing these challenges demands **a** systems-thinking approach**,** wherein operational strategies are integrated and performance is evaluated across shared KPIs. To move forward, HEB must commit to cross-functional transformation, aligning people, processes, technology, and finance in a unified operational architecture. Through this, the company can strengthen its resilience, responsiveness, and competitiveness in Malaysia's demanding offshore energy sector.

At the core of these findings lies the recognition that HEB's operational challenges are not isolated issues but are interlinked within a broader systemic context. The unpredictable nature of call-out contracts, for example, does not just affect revenue forecasting—it has downstream impacts on crane scheduling, technician deployment, equipment maintenance, and customer satisfaction. Likewise, a shortage of skilled workers is not merely an HR issue but directly correlates with safety risks, delayed service delivery, and regulatory non-compliance. These cascading effects highlight the need for an integrated operations management strategy that brings together technical processes, financial oversight, workforce planning, and digital enablement under a unified framework.

One of the most significant contributions of this study is its ability to move beyond surface-level symptoms to uncover root causes embedded in organizational structures, stakeholder relationships, and industry norms. For instance, the study revealed that while HEB possesses the technical capability and infrastructure to deliver world-class crane services, it is constrained by inefficiencies in contract design, outdated maintenance practices, and fragmented training pathways. These findings point to the importance of not only optimizing internal processes but also rethinking external engagement models with clients, suppliers, and regulatory bodies.

Moreover, the study demonstrates the strategic value of adopting emerging technologies such as predictive maintenance tools, digital compliance tracking, and AI-enabled resource forecasting. These innovations, if implemented effectively, could significantly enhance HEB's asset uptime, reduce unplanned downtimes, and

provide actionable data for performance monitoring. However, technological advancement must be accompanied by cultural transformation—one that fosters continuous learning, operational agility, and cross-functional collaboration.

For stakeholders—ranging from corporate executives and engineers to policy makers and academic researchers—this study offers practical insights and a conceptual framework that can be applied to similar operational contexts. The emphasis on thematic interconnectivity provides a model for diagnosing performance issues, prioritizing strategic interventions, and designing integrated solutions in other offshore or industrial service settings.

Ultimately, the findings of this study call for a paradigm shift in how offshore crane operations are managed. It is no longer sufficient to address problems in isolation or reactively. HEB, and similar firms, must adopt a proactive, systemic, and data-informed approach to operational management—one that is resilient, scalable, and adaptive to future challenges. By doing so, they not only enhance their competitiveness but also contribute to the robustness and safety of Malaysia's offshore energy infrastructure.

This study is constrained by its qualitative design and limited sample size of 13 stakeholders, which may restrict generalizability. While thematic analysis yielded rich insights, broader surveys or mixed-method approaches could provide more quantitative validation. Additionally, the study focused on the Malaysian context, particularly HEB's ecosystem. The findings may not directly translate to offshore crane operations in different geopolitical or regulatory environments. Similarly, the scope was limited to operations, excluding deeper financial modeling or macroeconomic sensitivity analyses. Interview data, while robust, may contain subjective biases or gaps in recollection. Despite efforts to validate responses through triangulation, not all insights could be independently verified.

Future studies should incorporate longitudinal data to track operational performance over time, especially in response to technology adoption or regulatory reforms. Comparative analyses between HEB and regional or global peers could also yield benchmarking insights. Lastly, the insights from this study provide a foundation for stakeholders, including policymakers, service providers, and academic researchers, to further enhance offshore crane operations in a challenging and evolving industry landscape.

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BUSINESS HIGHLIGHT: PROBLEMS AND SOLUTIONS

Handal Energy Berhad (HEB) is facing operational inefficiencies and declining profitability due to fragmented management practices across critical functions such as workforce development, maintenance, logistics, and financial planning. A heavy reliance on short-term contracts, an aging and under-skilled workforce, inconsistent maintenance strategies, and poor digital integration have collectively led to project delays, equipment downtime, underutilized resources, and ultimately, financial losses—evidenced by a RM35 million deficit reported in 2022. The absence of long-term strategic planning and the company's reactive, siloed decision-making model have weakened HEB's ability to respond to market volatility and client expectations, undermining competitiveness in Malaysia's offshore crane services industry.

To address these systemic challenges, HEB must transition to an integrated operational strategy centered on long-term value creation, resilience, and digital transformation. This involves four key actions: (1) building workforce capability through structured upskilling programs and industry partnerships to ensure talent continuity; (2) enhancing service reliability by adopting predictive maintenance systems and formalized service-level agreements (SLAs); (3) improving financial sustainability via agile budgeting tools, revenue diversification, and project-based cost tracking; and (4) strengthening technological readiness through an enterprise-wide digital roadmap, enabling data-driven decisions and operational transparency. By aligning people, processes, and platforms, HEB can restore its financial health, improve customer satisfaction, and secure a competitive advantage in a volatile offshore market.

