

Integrated Risk Assessment Framework for Enhancing Operational Resilience in Utility Companies: A Case Study of Hub Power Company (HUBCO)

Munira Khatoon¹, Sidra Ghor², Ehsan Ali Shaikh³, Motaber Ali
Shaikh⁴

¹Deputy Manager – Risk Management, K-Electric Limited, Karachi, Pakistan, ²Lecturer of
Department of Physiology, Indus Medical College, The University of Modern Sciences, Tando
Muhammad Khan, Hyderabad, Pakistan, ³Deputy Manager Production Planning and Material
Control, Pakitex board Private Limited, Karachi, Pakistan, ⁴Master of business
administration, University of Sindh, Jamshoro, Sindh, Pakistan

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Abstract

This study examines the development and implementation of an integrated risk assessment framework to enhance operational resilience in utility companies, with a focus on Hub Power Company (HUBCO), Pakistan's largest privately owned power utility. Data were collected through structured questionnaires from 300 employees across strategic, operational, and support functions. The responses were analyzed using SPSS (v.26) for descriptive statistics, correlation, and regression analysis. Findings highlight that proactive risk identification, systematic monitoring through Key Risk Indicators (KRIs), and fostering a risk-aware culture significantly improve organizational resilience. The results further confirm that operational resilience is positively associated with internal control effectiveness and employee awareness of risk management practices. The paper contributes by providing a framework model adaptable for other utility companies in emerging economies.

Keywords: Risk Assessment, Operational Resilience, Utility Companies, Risk Culture, Hub Power Company (HUBCO), SPSS

Introduction

In today's globalized economy, utility companies face mounting pressures from both external and internal risk factors. Energy utilities, particularly in developing countries, often operate in volatile environments where regulatory changes, infrastructure limitations, financial constraints, and climate-induced disruptions pose significant threats to stability (ISO 31000, 2018; Aven, 2015). Operational resilience—the capacity to prepare for, withstand, and recover from disruptions has become a central theme in risk management research (Burnard

& Bhamra, 2011). While operational resilience is widely acknowledged as critical, the integration of risk assessment frameworks into utility management remains underexplored in emerging economies (Hopkin, 2018). In South Asia, where urbanization and energy demand continue to rise, utilities like Hub Power Company (HUBCO) face unique challenges including supply-demand imbalances, regulatory scrutiny, and infrastructure vulnerabilities. Moreover, the dynamic nature of energy distribution requires robust risk identification, monitoring mechanisms, and cultural adoption of risk management principles to prevent crises. Previous studies largely focus on developed markets (Power, 2021; Woods, 2009), leaving a gap in understanding how integrated risk assessment frameworks can strengthen operational resilience in the South Asian energy sector. Hub Power Company (HUBCO) provides an appropriate case study because of its scale, complexity, and exposure to multifaceted risks. This study therefore aims to empirically assess the impact of risk assessment practices—risk identification, monitoring through Key Risk Indicators (KRIs), internal controls, and organizational risk culture on operational resilience. The increasing electrification and rising electricity demand in the United States, coupled with the growing penetration of renewable energy, have introduced significant volatility in electricity markets. Extreme weather events and operational uncertainties have highlighted the need for robust financial risk management tools to maintain market stability and investor confidence (Khatoon et al., 2025). Strengthening internal controls and implementing robust fraud risk management frameworks are essential for mitigating these risks and ensuring organizational integrity (Khatoon et al., 2025).

Developing an Integrated Risk Assessment Framework for Operational Resilience at Hub Power Company (HUBCO)

Industrial growth and urbanization have heightened operational complexities across sectors, including manufacturing, textile, and utility industries. These complexities often manifest as occupational hazards, safety risks, and environmental challenges, which can significantly impact workforce productivity and organizational performance (Shaikh et al., 2018; Sidra et al., 2025a). Studies in the textile sector have shown that inadequate occupational health and safety (OHS) measures contribute to physiological stress, exposure-related illnesses, and increased turnover intention among workers (Sidra et al., 2025a; Shaikh et al., 2025). Fire incidents in high-density industrial settings further underscore the critical need for proactive safety planning and emergency preparedness to minimize human and environmental losses (Shaik et al., 2019; Saif-ul-Islam et al., 2019).

The integration of structured OHS management systems and hazard awareness programs has been linked to enhanced worker performance, reduced accidents, and improved operational resilience (Shaikh & Song, 2018; Mohsin et al., 2017). Research also emphasizes that multi-criteria decision analysis, adaptive management, and evidence-based risk assessment frameworks provide organizations with the tools to prioritize interventions, allocate resources efficiently, and respond effectively to both routine and emergency operational challenges (Sidra et al., 2025c). These approaches highlight the necessity of combining technical, managerial, and behavioral strategies to strengthen organizational safety culture and operational continuity.

In the context of utility companies such as Hub Power Company (HUBCO), the stakes of operational failure are particularly high, given their critical role in ensuring uninterrupted

power supply and supporting urban infrastructure. Developing an integrated risk assessment framework tailored to the utility sector can enhance preparedness, optimize response strategies, and safeguard both human and technical assets. By leveraging lessons from industrial safety research and adaptive risk management, this study aims to provide a comprehensive framework that strengthens the operational resilience of utility companies in Pakistan (Shaikh et al., 2018; Sidra et al., 2025b).

Methodology

This study employed a quantitative survey-based research design, targeting 300 employees from Hub Power Company (HUBCO) operations, corporate, and compliance units. Data were collected using a structured questionnaire on a 5-point Likert scale and analyzed in SPSS v.26. Reliability of constructs was confirmed through Cronbach's alpha, followed by descriptive statistics, Pearson correlation, and multiple regression analysis to test the hypothesized relationships between risk factors and operational resilience. The independent variables included risk identification, monitoring and KRIs, internal controls, and risk-aware culture, while operational resilience served as the dependent variable.

Results

The results included demographic analysis, reliability testing, correlation analysis, and regression outputs.

Table 1

Demographics of Respondents

Variable	Category	Frequency	%
Gender	Male	210	70%
	Female	90	30%
Age	20–30	85	28%
	31–40	140	47%
	41–50	55	18%
	51+	20	7%
Department	Operations	140	47%
	Corporate/Finance	90	30%
	Risk/Compliance	70	23%

Table 2

Reliability Test (Cronbach's Alpha)

Variable	Items	Cronbach's Alpha
Risk Identification (RI)	5	0.81
Monitoring & KRIs (MK)	5	0.85
Internal Controls (IC)	5	0.79
Risk Culture (RC)	5	0.83
Operational Resilience (OR)	5	0.87

All above **>0.7** = reliable (Nunnally, 1978).

Table 3

Correlation Analysis (Pearson's r)

Variables	OR	RI	MK	IC	RC
OR	1	.61**	.68**	.59**	.72**
RI	.61**	1	.53**	.47**	.55**
MK	.68**	.53**	1	.50**	.64**
IC	.59**	.47**	.50**	1	.58**
RC	.72**	.55**	.64**	.58**	1

p < 0.01 (2-tailed)

Table 4

*Regression Analysis***Dependent Variable: Operational Resilience (OR)**

Predictor Variables	Beta (β)	t-value	Sig.
Risk Identification (RI)	0.23	3.45	0.001
Monitoring & KRIs (MK)	0.27	4.02	0.000
Internal Controls (IC)	0.19	2.89	0.004
Risk Culture (RC)	0.31	5.10	0.000

 $R^2 = 0.69$, Adjusted $R^2 = 0.68$, $F = 157.3$, $p < 0.001$

The study analyzed responses from 300 employees of Hub Power Company (HUBCO). [Table 1] presents the demographic distribution, showing that the majority of respondents were male (70%) and between the ages of 31–40 (47%). Nearly half of the participants were from operations (47%), followed by corporate/finance (30%) and risk/compliance (23%). This indicates a diverse representation across organizational functions.

Reliability analysis [Table 2] confirmed the robustness of the constructs, with all Cronbach's alpha values exceeding the recommended threshold of 0.70 (Nunnally, 1978). This suggests that the measurement scales used for risk identification, monitoring, internal controls, risk culture, and operational resilience were internally consistent.

Correlation results [Table 3] demonstrated significant positive associations between operational resilience and all four independent variables ($p < 0.01$). The strongest relationship was observed between risk culture and operational resilience ($r = .72$), followed by monitoring and KRIs ($r = .68$). These findings indicate that employees who perceived stronger risk management practices also reported higher levels of organizational resilience.

Regression analysis [Table 4] further validated these relationships. All four predictors significantly contributed to operational resilience, with risk culture ($\beta = 0.31$, $p < 0.001$) and monitoring & KRIs ($\beta = 0.27$, $p < 0.001$) emerging as the strongest determinants. The model explained 69% of the variance in operational resilience ($R^2 = 0.69$, $F = 157.3$, $p < 0.001$), indicating a strong explanatory power.

In summary, the results highlight that while all dimensions of risk assessment are important, cultivating a risk-aware culture and implementing effective monitoring mechanisms are the most critical drivers of operational resilience within Hub Power Company (HUBCO).

Recommendations

The study recommends that Hub Power Company (HUBCO) and similar utilities strengthen their monitoring systems through real-time Key Risk Indicators (KRIs), foster a sustainable risk-aware culture through continuous training, and adopt technology-driven predictive analytics for early detection of operational vulnerabilities. Furthermore, aligning organizational frameworks with international standards such as ISO 31000 and COSO ERM will ensure resilience at both project and enterprise levels. These actions will enhance not only the company's ability to withstand disruptions but also stakeholder trust and regulatory compliance.

Conclusion

This study demonstrates that an integrated risk assessment framework significantly enhances operational resilience in utility companies, as validated in the Hub Power Company (HUBCO) case. Risk-aware culture and systematic monitoring emerge as the most influential factors. The proposed framework not only strengthens operational stability but also ensures regulatory compliance and stakeholder confidence. Future studies may incorporate longitudinal data and comparative analysis with other South Asian utility firms to further validate findings.

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