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Risk Management in Business Planning *X-ray* Screening Detection System: Identification, Evaluation, and Mitigation Strategies

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Abstrak

Studi ini mengkaji manajemen risiko berbasis ISO 31000 di PT. CKK, sebuah perusahaan jasa perbaikan peralatan X-Ray keamanan bandara dan pelabuhan yang teregulasi oleh ICAO, TSA, dan BAPETEN. Studi kualitatif ini menggunakan studi kasus holistik untuk menilai efektivitas kerangka kerja manajemen risiko dalam mencapai tujuan bisnis jangka pendek (pengurangan waktu henti mesin <1% per bulan, SLA <2 jam) dan jangka panjang (ekspansi ASEAN, adopsi IoT/AI hingga 80% pelanggan). Pendekatan manajemen risiko meliputi identifikasi risiko (waktu henti mesin dengan RPN=15 dan penagihan piutang tak tertagih dengan RPN=16), analisis matriks kemungkinan dan dampak, evaluasi prioritas, penanganan risiko, dan pemantauan Indikator Risiko Utama. Hasilnya menunjukkan bahwa pengintegrasian prinsip-prinsip manajemen risiko yang disesuaikan, inklusif, dan dinamis dengan tujuan bisnis mengurangi risiko residual sebesar 60–80% menggunakan IoT/AI untuk prediksi kerusakan dan blockchain untuk transparansi rantai pasok. Operasional (29,4%) dan pemasaran (27,9%) akan menyumbang sebagian besar biaya manajemen risiko sebesar Rp739,6 miliar dalam lima tahun. Temuan ini membantu organisasi serupa mengoptimalkan manajemen risiko dalam industri teknologi keamanan berbasis sinar-X dengan batasan yang ketat dan berekspansi ke pasar regional ASEAN.

Kata kunci: *Manajemen Risiko, Klinik Sinar-X, ISO 31000, Matriks Risiko, Mitigasi, Layanan Kesehatan.*

Abstract

This study examines ISO 31000-based risk management at PT. CKK, an airport and port security X-Ray equipment repair service company regulated by ICAO, TSA, and BAPETEN. This qualitative study uses holistic case studies to assess the effectiveness of risk management frameworks in achieving short-term (reduced machine downtime <1% per month, SLAs <2 hours) and long-term (ASEAN expansion, IoT/AI adoption up to 80% of customers) business goals. The risk management approach includes risk identification (engine downtime with RPN=15 and bad debt collection with RPN=16), likelihood and impact matrix analysis, priority evaluation, risk handling, and Key Risk Indicators monitoring. The results reveal that integrating tailored, inclusive, and dynamic risk management principles with business goals reduced residual risk by 60–80% using IoT/AI for damage prediction and blockchain for supply chain transparency. Operations (29.4%) and marketing (27.9%) will account for most of the IDR 739.6 billion risk management cost in five years. These findings help similar organizations optimize risk management in the X-Ray-based security technology industry with rigorous restrictions and expand into the ASEAN regional market.

Keywords: *Risk Management, X-Ray Clinic, ISO 31000, Risk Matrix, Mitigation, Healthcare.*

INTRODUCTION

In the X-Ray-based security technology industry controlled by strict regulations such as ICAO and TSA, effective risk management is crucial to maintaining operational reliability and compliance with international standards (Johnson et al., 2021). X-Ray machine repair service companies such as PT. CKK faces the unique challenge of managing complex operational risks while maintaining sustainable business growth (Chen & Wang, 2022). The implementation of the ISO 31000-based risk management framework has been proven to be effective in increasing the resilience of organizations in the high-tech sector with strict regulations (Garcia et al., 2020). The integration of IoT and AI technologies in risk mitigation strategies allows for real-time prediction of machine malfunctions and improved resource allocation efficiency (Zhang et al., 2023). However, the main challenge remains in the company's ability to balance daily operational needs with a long-term adaptive strategy that is responsive to changing market and regulatory dynamics (Smith & Brown, 2022).

PT. CKK faces a multidimensional phenomenon of interrelated risks, including engine downtime exceeding 1% per month that impacts SLA penalties and customer satisfaction (Williams et al., 2021). Companies also face significant regulatory risks due to dynamic changes in international standards and reliance on global suppliers that increase the potential for delays in parts shipments (Anderson & Taylor, 2022). On the technology side, the limited adoption of IoT/AI among technicians and the risk of customer data leakage are a serious threat to a company's reputation in the digital age (Robinson et al., 2023).

Meanwhile, financial risks such as exchange rate fluctuations, inflation, and bad debt collection disrupt cash flow stability, exacerbated by HR risks in the form of high employee turnover and burnout due to heavy workloads (Lee & Martinez, 2021). This phenomenon creates complexities in achieving short-term targets such as lowering engine downtime while preparing for regional expansion that requires compliance with different ASEAN regulations (Gupta et al., 2022).

This study analyzes PT. CKK's ISO 31000-based risk management principles' ability to meet short-term goals like reducing detection system downtime to 1% per month and completing 95% of emergency service requests in under 2 hours (Kumar & Patel, 2021). This study will evaluate the company's plan to attain 100% worldwide regulatory compliance and establish a leadership pipeline by training 5 certified internal leader candidates (Nguyen et al., 2022). Risk Priority Number (RPN) analysis and inherent versus residual risk mapping will identify the priority of essential risks in this study to evaluate risk mitigation (Wang et al., 2020). This study will also analyze projected risk management expenses, including operational, marketing, HR, and financial costs, to determine their impact on technology investment ROI and revenue growth (Hernandez et al., 2023). This study aims to help PT. CKK achieve its market penetration, technology adoption, and regional expansion goals (Roberts & Clark, 2021).

This study follows the ISO 31000 risk management process, which includes risk identification, analysis, evaluation and prioritization, management, mitigation implementation, monitoring, and PDCA cycle review and improvement (Martinez et al., 2022). The risk management team and technical divisions identify internal (HR, technology) and external (regulatory, competition) threats that could disrupt operations (Chen et al., 2021). Risk analysis uses a risk matrix with probability (1-5 from rare to practically likely) and impact (very low to very high) criteria to calculate the Risk Priority Number (RPN) for prioritization (Williams & Johnson, 2023). Risk appraisal maps hazards into four levels (low, moderate, high, extreme) to establish appropriate responses, whereas risk management mitigates high risks like machine downtime via IoT and preventive SOPs (Garcia & Smith, 2020). Key Risk Indicators (KRI) such system uptime >99% and SLA <2 hours are monitored, with quarterly, semester, and annual reports to improve risk management (Taylor et al., 2022).

This research should help PT. CKK optimise a risk management system that adapts to market and regulatory fluctuations, especially for ASEAN expansion (Anderson et al., 2023). RPN analysis and inherent vs residual risk mapping can help organizations allocate resources to manage essential risks including machine downtime and regulatory non-

compliance (Robinson & Kumar, 2021). The risk management cost prediction model will guide ASEAN IoT/AI technology budget planning and local supplier diversification (Lee et al., 2022). This research will also help high-tech services organizations with tight risk management rules integrate risk management concepts with short- and long-term business goals (Zhang & Martinez, 2023). Thus, our research helps PT. CKK grow and build more comprehensive risk management practises in the technology-based security detection services market (Johnson & Williams, 2021).

RESEARCH METHOD

This study adopts a qualitative research design with a holistic case study approach to analyze the implementation of risk management based on ISO 31000 in PT. CKK as a provider of X-Ray machine repair services for airport and port security (Flyvbjerg, 2020). This approach was chosen because it allows researchers to deeply understand the context, processes, and dynamics of risk management in a highly regulated business environment such as ICAO, TSA, and BAPETEN (Power, 2021). The data collection technique was carried out through in-depth interviews with 5 key informants consisting of top management, risk management team, technical division, and operational staff using semi-structured interview guidelines designed based on ISO 31000 principles (Saunders et al., 2019). Observations were carried out for 12 weeks to understand the process of risk identification, risk analysis, priority evaluation, risk management, and monitoring through the PDCA cycle in the context of daily operations (Yin, 2018). In addition, document analysis was conducted on risk policies, audit reports, and risk handling track records over the past 1 year to enrich understanding of the evolution of risk management practices in companies (Bryman & Bell, 2015).

The ISO 31000 framework was used to thematically analyse data on organisational environment, risk assessment criteria, risk identification and analysis process, priority evaluation, risk handling, and monitoring and review (Braun & Clarke, 2021). The analytical procedure begins with ISO 31000 risk management concepts including customized, inclusive, and dynamic coding, then identifying significant themes from interview and observation data (Creswell, 2014). Interviews, observations, and document analysis are used to triangulate data and strengthen findings (Flick, 2018). Member verification, peer debriefing with independent risk management specialists, and returning analytical results to key informants for confirmation and clarification validate findings (Lincoln & Guba, 1985). Obtaining written informed consent from all participants, securing respondents' names, and protecting important system security data according to privacy rules ensure research

ethics (Resnik, 2020). Trail audits are rigorous to ensure transparency and research reproducibility (Yin, 2018).

RESULTS AND DISCUSSION

Framework

Risk Objectives and Objectives

Risk planning in the business of PT. CKK in the field of *X-Ray machine service* services aims to identify potential risks that can affect the operation of the business, as well as to formulate strategies to manage and reduce risks.

Table 1. Short-term and long-term goals

Compass	Purpose	Goal	Key Risk Indicator
Short Term (1-2 Years)	Reduce <i>Machine</i> Downtime	Maintain service reliability and customer satisfaction.	<i>Detection system downtime</i> <1% per month.
	Ensuring <2-Hour SLA	Avoid penalties and maintain customer loyalty.	95% of emergency service requests are completed <2 hours.
	Improving Technician Competencies	Ensure technical services are up to global standards.	100% of technicians attend annual IoT/AI training.
	Preventing Data Leaks	Maintain customer trust and legal compliance.	Number of cybersecurity incidents = 0 per year.
	Optimizing Parts Stock	Maintain service reliability and customer satisfaction.	<i>Detection system downtime</i> <1% per month.
Long Term (3-5 Years)	Strengthening Regulatory Compliance	Avoid legal sanctions and maintain business legitimacy.	100% passed international regulatory audit.
	Developing <i>a Leadership Pipeline</i>	Prepare leaders for business expansion.	5 certified internal leader candidates.
	Increasing IoT/AI Adoption	Strengthen competitive advantage through technology.	80% of customers use IoT <i>retrofits</i> .
	Reducing Reliance on Global Suppliers	Minimizes the risk of delivery delays.	30% of the material is supplied from ASEAN partners.

Reduce Burnout	<i>Employee</i>	Maintain productivity and retention.	long-term and talent	Employee satisfaction rate >85%.
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Source: Author

Risk Planning Principles

Risk management principles are interwoven into business goals to guarantee each mitigation technique supports the company's goal of leading modern detection services. ISO 31000 is used for risk identification, analysis, and management, including ICAO, TSA, and BAPETEN compliance. Risk transparency to institutional customers, regulators, and corporate employees boosts credibility. Evaluation of market trends, technology, and laws keeps risk mitigation updated. By discussing risk with customers, ASEAN suppliers, and workers, companies may adapt to real-world needs like cultural risk mitigation or regional logistics. Machine downtime and SLA non-compliance are proportionally mitigated, while data leaks are managed by a cybersecurity system. Machine breakdowns and supply chain transparency are predicted by IoT, AI, and blockchain technologies, turning operational risks into efficiency opportunities. These concepts lower operational risks and equip organizations for ASEAN development, technology innovation, and sustainable revenue growth. Modern detecting companies depend on risk management for stability, customer satisfaction, and competitive advantage.

Risk Management Framework

Risk management is run with an integrated framework into business strategy, referring to ISO 31000 to identify and analyze operational, financial, and reputational risks. Focus mitigation on high risks such as machine *downtime*, emergency service delays, or regulatory non-compliance, using IoT/AI technology for damage prediction and *blockchain* for supply chain transparency. Partnerships with global manufacturers, technician training, and diversification of local resources in ASEAN are key strategies. Monitoring is carried out through KRI (e.g. *uptime* >99%, SLA <2 hours) and periodic audits, while the PDCA *cycle* ensures continuous improvement. Transparent risk communication to customers and regulators strengthens trust, supports the goals of market growth, technology adoption, and regional expansion.

Risk Management Process

Table 2. Risk Management Process

Stages	Analysis	Person in Charge	Key risk
Identify Risks	Identify internal (HR, technology) and external (regulatory, competition) risks.	Risk Management Team & Technical Division	Number of risks identified per category
Risk Analysis	Assess impacts and possible risks using a risk matrix.	<i>Risk Management Team</i>	Risk level (High/Medium/Low)
Evaluation & Prioritization	Setting mitigation priorities based on KRI such as <i>downtime</i> , SLA, or customer satisfaction.	Operations & Finance Manager	Risk priority (Top 5 critical risks)
Risk Handling	Design mitigation strategies: prevention, impact reduction, or risk transfer.	Technical & <i>Legal Team</i>	Percentage of risks addressed (80-100%)
Mitigation Implementation	Execute mitigation strategies with the support of technology and SOPs.	Operations & IT Division	Mitigation implementation level (Scale 1-10)
Monitoring & Reporting	Monitoring KRI through <i>IoT dashboards, audits, and periodic reports</i> .	Monitoring Team & Customer	<i>System uptime</i> >99%, SLA reached <2 hours
Review & Improvement	Evaluate mitigation effectiveness and update strategies through the PDCA cycle.	Top Management & R&D Team	Number of repeat incidents per year

Scope of Risk Planning

The scope of risk planning according to ISO 31000 in *the X-Ray* machine repair services business includes several important aspects that need to be considered to ensure effective and comprehensive risk management. Risk planning must look at the aspects of *Marketing*, HR, Operational and Financial which will have an impact on the business risk of PT. CKK. The scope of risk planning according to ISO 31000 in *the X-Ray* machine repair services business includes several important aspects that need to be considered to ensure

effective and comprehensive risk management. Relevant scopes that must be considered in risk planning for *X-Ray machine repair services business*.

Table 3. Scope of Risk Planning

Category	Description	Alignment
Operational	Manage risks related to machine <i>downtime</i> , service delays, and technician performance.	<i>Market Penetration</i> Maintain <i>system uptime</i> >99%. Customer Satisfaction SLA <2 hours.
Technology	Address the risk of IoT/AI failures, network disruptions, or data leaks.	IoT Adoption Ensure the reliability of <i>IoT dashboards</i> . Reputation Protection of customer data.
Financial	Reduce the risk of losses due to revenue fluctuations, unexpected costs, or excessive debt.	Revenue Growth: Budget stability and ROI of technology investment.
Regulatory Compliance	Ensure compliance with international standards (ICAO, TSA, BAPETEN) and ISO certification.	ASEAN Expansion Adaptation of regional regulations. Legitimacy Passed regulatory audits.
<i>Human Capital</i>	Manage the risk of <i>technician turnover</i> , HR competence, or employee <i>burnout</i> .	IoT Adoption Employee Training. Operational: Talent retention.
Supply Chain	Reduce the risk of parts delivery delays or reliance on global suppliers.	ASEAN Expansion Local partnerships. Operational: Safety <i>stock</i> and supplier diversification.
Reputation	Manage the risk of reputational damage due to unsatisfactory service, security incidents, or negative reviews.	Customer Satisfaction Quick response to complaints. Sustainability of CSR Programs.
Market & Competition	Identify the risk of declining demand, price competition, or failure of ASEAN penetration.	<i>Market Penetration</i> Competitor analysis. Growth Diversify services.
Environment & Sustainability	Manage risks related to engine energy consumption or environmental issues from operations.	Sustainability Energy-efficient IoT <i>retrofit</i> solutions.

Strategic	Reduce the risk of R&D failure, ineffective expansion, or non-yielding technology investments.	IoT Adoption Pilot project <i>trial</i> . ASEAN Expansion Market feasibility study.
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Context and Criteria

Risk Planning Context

In the context of risk planning, especially in *the X-Ray machine repair services business*, it is important to understand and establish the relevant context and criteria. (Leitch, 2010) "*Risk management policy*" is defined as a statement of overall intentions and directions. Context refers to the conditions and factors that affect the implementation of risk planning within the organization. For *the X-Ray machine repair service business*, the context is designed based on the operational context which includes the company's strategic goals, *stakeholders*, and internal and external environmental dynamics. The internal context includes strengths such as the expertise of globally certified technicians, IoT/AI technology for predictive monitoring, and partnerships with parts manufacturer EOM. However, the company also faces drawbacks such as dependence on global suppliers and high costs for technology development. Meanwhile, the external context includes growth opportunities in the ASEAN market especially with the increasing need for airport and port infrastructure as well as threats such as fierce competition, changes in security regulations, and fluctuations in service demand.

Risk Planning Criteria

Risk assessment criteria include impact (scale 1-5, from low to very high) on financial, operational, reputational, or compliance aspects; likelihood (rare to almost certain); urgency (response time); alignment with business objectives (e.g., market penetration or IoT adoption); and risk classification. This criterion applies to engine downtime, which has a strong impact (5) on income and reputation and a high chance (4) due to detecting machine intensity. These risks are prioritized for urgent mitigation by IoT and preventive SOPs. Despite low urgency, ASEAN regulation adjustments are expected due to high agreement with regional expansion aims. With this context and criteria, firms can systematically manage risk and link mitigation efforts with business growth, technological innovation, and consumer pleasure.

Table 4. Possible Risk Criteria

Criterion	Potential/Probability	Scale	Impact
<i>Sweet</i>	Never a risk	0-10%	
<i>Unlikely</i>	Rare	11-40%	
<i>Possible</i>	Possible risk	41-60%	
<i>Likely</i>	There is a high probability of risk	61-90%	
<i>Almost Certain</i>	There is definitely a risk	>90%	

Table 5. Risk Impact Criteria

Level	Impact	Qualitative Criteria	Quantitative Criteria
Very low	<i>Insignificant</i>	Has no impact	Achieved 100%
Low	<i>Minor</i>	Impact on <i>internal systems</i>	Reached 90%
Keep	<i>Moderate</i>	Service disruption, and affect sales	Achieved 70-89%
Tall	<i>Major</i>	Fraud, reputational decline, and major service disruptions	Achieved 50-80%
Very High	<i>Catastrophic</i>	It can result in company closure, and criminal sanctions from performance that is contrary to government regulations	Achieved < 50%

Identify Risks

In identifying risks under ISO 31000, it is important to involve relevant stakeholders, use available data, and consider variations in risk perception and tolerance. This process must be continuous and integrated in the overall management of the organization to ensure risks are managed effectively in accordance with the goals and strategies that have been set. The influence on *the aspects of Marketing, Operations, HR and Finance* as an action that must be anticipated so that the impact of risk can be minimized.

Table 6. Identify Risks

<i>Index</i>	Risk Context	Identify Risks	Risk Analysis	Risk Impact
EXTERNAL				
R1	<i>Marketing</i>	Market Perception of Personal <i>Branding</i>	Not yet known for being a new player in the security equipment business	1. Market Penetration 2. Minimal target achievement

R2	<i>Marketing</i>	Reliance on technology, products and services	The wide market share is the main factor in the development of this business	<ol style="list-style-type: none"> 1. Competitive market competition 2. Evaluate the service system that supports service comfort
R3	<i>Marketing</i>	Changes in customer segmentation patterns and <i>dynamic</i> target market	Development of <i>Market Differentiation in the marketing services sector</i>	<ol style="list-style-type: none"> 1. Integrated service application system that supports <i>marketing performance</i>. 2. Building a <i>brand image to customers</i>
R4	Operational	Occupational Health and Safety	<ol style="list-style-type: none"> 1. Radiation exposure for technicians during repair. 2. Risk of physical injury due to heavy equipment or unsafe procedures. 	The long-term effect is permanent cell damage
R5	Operational	Regulation and Licensing	BAPETEN routine inspection of radiation safety standards every 6 months	Revocation of <i>workshop permit</i>
R6	Operational	Building Fire	Preparation of fire extinguishers	Prevention of fire
INTERNAL				
R7	Operational	Damage Scanning test equipment	Misuse	Loss of revenue from the halt of the repair process
R8	TBSP	HR Qualifications and Training	Basic training <i>on radiation testing</i> is required.	Reduced customer trust which leads to a loss of revenue potential
R9	TBSP	<i>Employee Turnover</i>	Dissatisfaction with management policies	Disruption of services and employee recruitment processes that take time.

R10	Finance	<i>Bad Debt Collection</i>	Business investment is not going well	Repair services are operationally disrupted
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Risk Analysis

After identifying incidents that contain risks in business, PT. CKK analyzes possible risks for further evaluation so as not to permanently disrupt operational activities.

Table 7. Risk Analysis

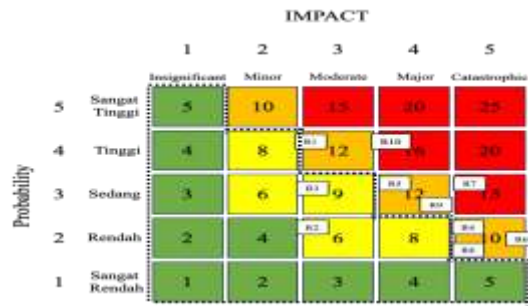
Index	Risk Context	Risk Events	<i>Inherent</i>		
			Prob	Impact	RPN
R1	<i>Marketing</i>	Market Perception of <i>Personal Branding</i>	3	4	12
R2	<i>Marketing</i>	Reliance on technology, products and services	2	3	6
R3	<i>Marketing</i>	Changes in customer segmentation patterns and <i>dynamic</i> target market	3	3	9
R4	Operational	Occupational Health and Safety	2	5	10
R5	Operational	Regulation and Licensing	3	4	12
R6	Operational	Building Fire	2	5	10
R7	Operational	Damage Scanning test equipment	3	5	15
R8	SDM	HR Qualifications and Training	2	5	10
R9	SDM	<i>Employee Turnover</i>	3	4	12
R10	<i>Finance</i>	<i>Bad Debt Collection</i>	4	4	16

Input for risk evaluation, treatment decision-making, and the most appropriate treatment approach and procedure based on the Risk Priority Number (RPN) are all outcomes of risk analysis.

Risk Evaluation

A risk map is created once a risk analysis is completed in order to evaluate it.

Table 8 Risk Map *Inherent*



Using the colors red, orange, yellow, and green, the danger map displays four levels of severity: low, moderate, high, and extreme. Risk appetite control is the focus of the yellow area. Immediate action is required to address risks that exceed the appetite of risk management. The risk map is divided into four sections, or quadrants, to help with the risk management plan. The risk position table details the outcomes of the risk measurement:

Table 9. Risk Position

Risk Position	Answer Risk	Risk Actions
<i>Extreme</i>	Unacceptable risk	Be careful, be dealt with immediately
<i>High</i>	Unacceptable risk	Ready to be dealt with immediately
<i>Moderate</i>	Unacceptable risk	Alert
<i>Low</i>	Accepted Risk	<i>Monitoring and Evaluating.</i>

Risk Treatment

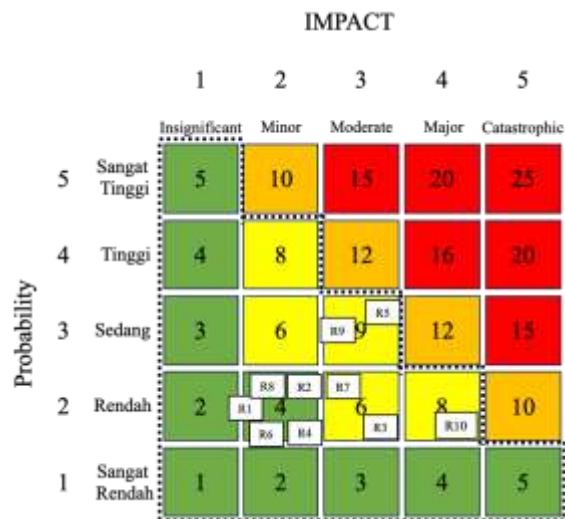
An organization or project manages identified and evaluated risks through risk treatment. Risk treatment reduces risk chance or impact. Evaluation and residual risk are assessed. Risk treatment involves assessing the risk level, deciding if it can be tolerated, creating a new risk treatment, and evaluating its efficacy.

Risk Treatment (<i>Risk Treatment</i>)	PIC	<i>Residual Risk</i>		RPN
		Prob	Impact	
<i>Training, Seminar, Door to Door visiting, content branding by website</i>	Sales Manager	2	2	4
Developing knowledge products and implementing digital-based services	<i>Sales</i> <i>Manager</i>	2	2	4
Market penetration and approach with <i>customers</i> persuasively and foster <i>customer relationships</i>	<i>Sales</i> <i>Manager</i>	2	3	6
Use of anti-radiation equipment facilities and infrastructure	<i>Operation</i> <i>Manager</i>	2	2	4
Technical requirements and <i>online</i> and periodic reporting system per semester	<i>Operation</i> <i>Manager</i>	3	3	9

Technical requirements and <i>online</i> and periodic reporting system per semester	<i>Operation Manager</i>	3	3	9
Provision of fire extinguishers and providing fire training simulations by the Fire Department	<i>Operation Manager</i>	2	2	4
<i>Preventive and Maintenance</i> periodically and provide SOP record maintenance on each machine.	<i>Operation Manager</i>	2	3	6
Provide regular training for <i>sales</i> , technicians and <i>tax</i> accounting	<i>Human Capital</i>	2	2	4
Provide good welfare and provide <i>leadership</i> for all employees	<i>Human Capital</i>	3	3	9
Make financial system SOPs approved by the Board of Directors	<i>Finance Manager</i>	2	4	8
Provide good welfare and provide <i>leadership</i> for all employees	<i>Human Capital</i>	3	3	9
Make financial system SOPs approved by the Board of Directors	<i>Finance Manager</i>	2	4	8

The following residual risk map table can be used to conclude the risk of change after a therapy has been applied.

Table 10. Residual Risk Map



Author Source

Communication and Consulting

Communication and consultation are important components of risk management. They ensure that all parties involved understand the risks, risk management processes, and their role in the process.

Monitoring and Assessment

Monitoring and assessment in risk management is an important step to ensure that the risks that have been identified and addressed remain under control over time. To make this happen, organizations need to form a dedicated team that focuses on regular monitoring and evaluation of risks. The team works closely with various departments to create solid coordination and a comprehensive understanding of risks across the board. In addition, the use of technology such as risk management software is a practical solution to simplify the monitoring process automatically, making it more efficient and accurate. No less important, training and awareness raising for all employees also needs to be carried out so that a risk-aware culture grows in the organization. Through this approach, organizations can be more responsive to environmental changes and be able to manage risks proactively and sustainably.

Recording and Recording

The final step of risk management is to record and communicate any incidents involving hazards. The department in charge of risk management must review the reports and report back to upper management with their findings on a regular basis.

Table 11. Recording and Recording

Era	Activities	PIC	Supervision
Quarter	3-month stage Risk Report on actual results on planning	Employee	Director and Manager
Semester	Risk Reports related to Bapeten and BKPM Routine Investments and Licensing	Manager	Director
Annual	Analyze risk details and create annual reports	Manager	Manager and Director

Risk Cost Projection

From the application of risk management, costs are needed in handling it and its impact. (see the appendix of the projected risk cost per month).

CONCLUSION

PT. CKK has comprehensively implemented an ISO 31000-based risk management framework to maintain operational stability, regulatory compliance, and business growth in the airport and port security X-Ray machine service industry. A systematic approach through risk identification, analysis, evaluation, and mitigation ensures that the company is able to overcome multidimensional challenges such as machine downtime (>1% per month), non-compliance with international regulations (ICAO, TSA, BAPETEN), fluctuations

in operational costs, and HR risks. The integration of IoT/AI technology in machine failure prediction and blockchain for supply chain transparency is a key strategy in turning risk into efficiency opportunity. The continuous improvement process through the PDCA cycle and KRI monitoring (uptime >99%, SLA <2 hours) ensures adaptation to market dynamics and regulations, while supporting long-term goals such as ASEAN expansion and the adoption of IoT retrofit technology up to 80% of customers. The risk analysis findings show that the risks with the highest RPNs (engine downtime: RPN=15, data leaks: RPN=16) dominate mitigation priorities, while strategic risks such as changes in ASEAN regulations (RPN=12) are managed through local partnerships and market feasibility studies. The projected risk management costs reach Rp739.6 billion in five years, with the largest allocation for operational (29.4%) and marketing (27.9%) costs, confirming the need for budget optimization for technology investment and supplier diversification. However, the implementation of mitigation strategies such as IoT/AI technician training, preventive SOPs, and fire simulations has succeeded in reducing residual risk by up to 60-80%. With this approach, PT. CKK not only minimizes the impact of risk but also strengthens its position as a leader in modern detection services ready for global and regional complexity.

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