Available *online* at: https://bit.ly/SISFOTEKJAR

Jurnal Sistem Informasi dan Teknologi Jaringan

(SISFOTEKJAR)

ISSN (Print) 2808-7917 | ISSN (Online) 2807-9256

Implementing a Risk-Based Hiring System Using the Spiral Model at PT. Indonesia Gadai Oke

Muhammad Adam Gozali[1], Martiano[2]

[1,2]Fakultas Ilmu Komputer dan Teknologi Informasi, Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia

[1]adamgozalimuhammad@gmail.com, [2] Martiano@umsu.ac.id

ARTICLE INFORMATION

Received: June 10, 2025
Revised: Agust 19, 2025
Available online: September 03, 2025

KEYWORDS

Recruitment, Information System, SDLC Spiral Model, FMEA, Risk Analysis

CORRESPONDENCE

Phone : 081371564961

E-mail: adamgozalimuhammad@gmail.com

ABSTRACT

This study aims to address the inefficiencies and risks in the manual recruitment process at PT. Indonesia Gadai Oke, which often leads to data inconsistency, document loss, and subjective evaluations. To overcome these challenges, a Hiring Management System was developed using the Software Development Life Cycle (SDLC) with a Spiral Model approach that emphasizes risk analysis and mitigation throughout the development process. The system's effectiveness was evaluated by applying Failure Mode and Effect Analysis (FMEA) both before and after its implementation to identify, assess, and prioritize risks based on the Risk Priority Number (RPN). The results show that the implementation of the risk-based Hiring Management System significantly reduced the RPN across all recruitment stages — the highest initial RPN in the manual process, which was 336 (for application reception), decreased to 60 after system implementation. This indicates that the system effectively minimizes potential failures, increases efficiency, and enhances objectivity in the recruitment process. In conclusion, the risk-based Hiring Management System developed using the Spiral Model and evaluated through FMEA has proven effective in mitigating critical risks and improving the overall recruitment process at PT. Indonesia Gadai Oke.

1. INTRODUCTION

Recruitment is a crucial process in Human Resource Management (HRM) aimed at acquiring quality employees to achieve company goals [1]. An effective recruitment process is essential for a company's operations and success. Along with technological advancements, the recruitment process has undergone a significant transformation: the implementation of a digital-based hiring system allows companies to manage recruitment more efficiently and effectively, as demonstrated in prior studies showing that such systems facilitate applicant data management and enhance selection efficiency.

In developing information systems, the Software Development Life Cycle (SDLC) with a spiral model approach is often used [2]. The spiral model essentially combines the waterfall and prototyping paradigms while placing strong emphasis on risk analysis at each stage [3]. Its iterative nature looping through phases such as planning, risk analysis, engineering, and evaluation enables developers to respond flexibly to changing user needs and detect risks early in the lifecycle [4]. Applied a cyclical development methodology for the EDUDA application, incrementally building and refining components to align with evolving user requirements [5].

Despite technological progress, many companies still rely on manual internal systems, particularly in recruitment management. Preliminary research revealed that PT. Indonesia Gadai Oke continues to use manual tools such as Microsoft Word, Excel, Gmail, and Instagram to manage recruitment announcements and applicant tracking. This manual approach introduces systemic risks, including data inconsistency, loss of critical documents, limited validation of applicant data, and potential bias in candidate selection all of which can severely impair decision quality in human resources.

To address these challenges, this research proposes the design and implementation of a Hiring Management System grounded in a risk-based approach. The Failure Mode and Effect Analysis (FMEA) methodology is employed to identify, evaluate, and mitigate risks in each recruitment stage [6]. In FMEA, the Risk Priority Number (RPN) is computed as the product of Severity (S), Occurrence (O), and Detection (D) indices, thus enabling prioritization of failure modes [7]. This study applies FMEA both before and after system deployment, measuring how much the RPN values decrease, thereby evaluating the effectiveness of the system in reducing potential errors in the recruitment process at PT. Indonesia Gadai Oke.

2. METHOD

This research utilized a quantitative approach with a structured methodology to ensure valid and reliable results [8]. The system development employed the spiral model, chosen for its ability to handle risks and its flexibility in software development. This method allows for the gradual development of the Hiring Management System, enabling evaluation and improvement in each iteration.

Data was collected through three primary techniques:

1. Observation: Direct observation of recruitment activities at PT. Indonesia Gadai Oke was conducted to gather accurate and comprehensive data.
2. Interview: Direct interviews were held with the HRD and IT team at PT. Indonesia Gadai Oke to obtain necessary information regarding the existing recruitment flow and its associated risks.
3. Literature Study: Data was gathered from various written sources, such as journals and e-books, to support the theoretical framework of the research.

The development of the Hiring Management System followed the six stages of the Spiral Model:

1. Customer Communication: Interviews were conducted with HRD at PT. Indonesia Gadai Oke to gather user requirements for the system.
2. Planning: This stage involved defining the resources, timeline, and information needed for development.
3. Risk Analysis: Potential risks in the recruitment process were identified and mitigation strategies were integrated into the system design. This study used the Failure Mode and Effect Analysis (FMEA) method to identify, assess, and mitigate risks. FMEA variables included Severity (S), Occurrence (O), and Detection (D), which were used to calculate the Risk Priority Number (RPN) with the formula [9]:

   $$RPN = S \times O \times D \quad (1)$$

   Information :
   S : Severity
   O : Occurrence
   D : Detection
   This method is used to measure the failure rate in the recruitment process, both before and after using the system.
4. Engineering: The system design was created using Unified Modeling Language (UML), including use case diagrams, activity diagrams, and class diagrams, along with database and interface design.
5. Build and Publish: The system was developed as a web-based application and tested to ensure all functionalities operated correctly.
6. Customer Evaluation: The system was tested directly by the HRD department, and feedback was collected for further adjustments to meet the company's needs.

3. RESULTS AND DISCUSSION

The research was conducted in two main iterations following the spiral model: the first analyzing the manual recruitment process (before the system) and the second analyzing the process after the implementation of the digital Hiring Management System.

1. First Iteration (Before System Implementation)

In the first iteration, the manual recruitment process at PT. Indonesia Gadai Oke was analyzed. This process was heavily reliant on physical documents and manual record- keeping, leading to risks such as data loss, administrative errors, and subjective evaluations. An FMEA was conducted to quantify these risks [10]. The results, as shown in Table 1, identified the reception of applications and the selection interview as the stages with the highest risk.

Table 1. First iteration Risk Analysis Table

No	Recruitment Stage	Potential Failure	Effects of Failure	S	O	D	RPN
1	Preliminary Reception of Applications	Applicant data is lost or archives are messy	Selection process is delayed or candidate is missing	8	7	6	336
2	Employment Tests	Test results are not documented or lost	Inaccurate assessment	9	6	5	270
3	Selection Interview	Schedule clashes or not delivered	Candidates are absent or lose their candidacy	7	7	6	294
4	References & Background Check	Unverified references or fake documents	Invalid candidate passed	8	5	6	240
5	Medical Evaluation	The certificate is invalid or incomplete	Undetected health risks	9	4	5	180
6	Supervisory Interview	Supervisor received incomplete summary	Wrong supervisory decision	7	5	6	210
7	Realistic Job Previews	Candidates do not receive a realistic job description	Job mismatch	6	5	6	180
8	Hiring Decision	The decision is inconsistent with the selection results	Wrong choice of candidate	8	6	5	240

The analysis showed that the application reception stage had the highest RPN of 336, primarily due to the risk of losing applicant data and disorganized archives. The selection interview stage also had a high RPN, caused by scheduling conflicts and poor documentation. These findings guided the engineering phase, where the system was designed with features like digital

application forms, integrated scheduling, and automated notifications to mitigate these critical risks.

2. Second Iteration (After System Implementation)

In the second iteration, the digital Hiring Management System was implemented. This system integrated all recruitment stages, from online applications and testing to interview scheduling and final decision-making. A second FMEA was conducted to evaluate the effectiveness of the system in reducing the previously identified risks [11]. The results are presented in Table 2:

Table 2 Risk Analysis Table Second Iteration

No	Recruitment Stage	Potential Failure	Effects of Failure	S	O	D	RPN
1	Preliminary Reception of Applications	Data failed to upload or is in the wrong format	Application not entered into the system	5	3	4	**60**
2	Employment Tests	Time zone differences	Scheduling is temporarily disrupted	6	3	3	**54**
3	Selection Interview	Link or scheduling problem	Interview postponed	5	2	3	**30**
4	References & Background Check	The system failed to validate the document	Process pending	5	3	4	**60**
5	Medical Evaluation	Document is unreadable or incorrectly formatted	Revalidation required	6	2	3	**36**
6	Supervisory Interview	Incomplete summary due to human error input	Supervisor's decision is less accurate	4	2	3	**24**
7	Realistic Job Previews	Video not playing or content incomplete	Candidates don't understand the job well	4	2	3	**24**
8	Hiring Decision	Decision input error	Wrong contractor re-hiring	4	2	3	**24**

The results from the second iteration demonstrated a significant reduction in RPN across all stages. The highest RPN dropped to 60, a substantial improvement from the 336 recorded in the manual process. This indicates that the digital system was highly effective in minimizing the frequency and impact of failures while improving the detection of potential issues.

3. Comparison and Discussion

The comparison between the two iterations, summarized in Table 3, clearly illustrates the positive impact of the Hiring Management System.

Table 3. Risk Analysis Table of Evaluation Results

No	Recruitment Stage	RPN First Iteration	RPN Second Iteration	Decline RPN
1.	Preliminary Reception of Applications	336	60	276
2.	Employment Tests	270	54	216
3.	Selection Interview	294	30	264
4.	References & Background Check	240	60	180
5.	Medical Evaluation	180	36	144
6.	Supervisory Interview	210	24	186
7.	Realistic Job Previews	180	24	156
8.	Hiring Decision	240	24	216

4. Interface Hiring Management System

The developed application interface (UI) supports the digital recruitment process, although the system doesn't perform automatic calculations. The web-based Hiring Management System aims to simplify HR's process of managing applicant recruitment processes.

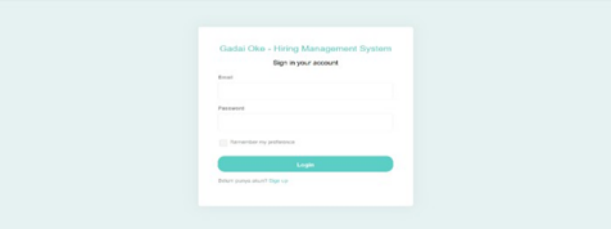

Figure 1. Login Page

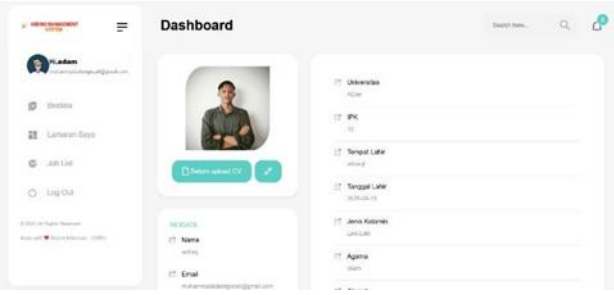

Figure 2. User Biodata Page

Figure 3. User Application Page

Figure 4. Job List Pages

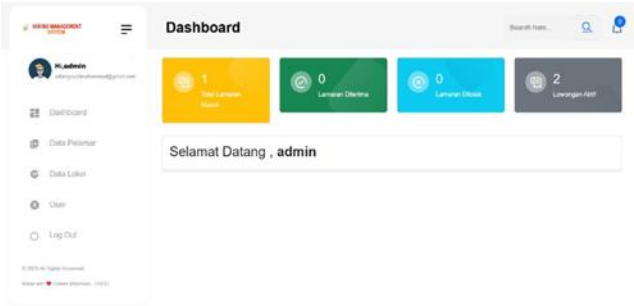

Figure 5. Admin Dashboard Page

Figure 6. Applicant List Pages

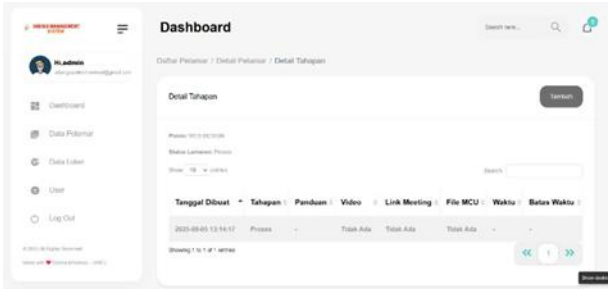

Figure 7. Stage Detail Page

Figure 8. Add Status and Instructions Form

Figure 9. Job Vacancy Data Page

Figure 10. Add and Edit Vacancies Form

5. CONCLUSIONS

Based on the analysis and implementation of the risk- based recruitment system, it can be concluded that this approach provides a deeper understanding of potential failures at each recruitment stage. The developed system can assist HR in minimizing risks through digital features such as assessment forms, job preview videos, and uploading health documents. Evaluations of five applicants indicated that the HR interview stage is a critical, high-risk point, and the system was designed to reduce subjectivity and increase assessment accuracy. Overall, this system contributes to a more objective, efficient, and well-documented recruitment process.

6. ACKNOWLEDGMENT

The author would like to thank Prof. Dr. Agussani, M.AP., Assoc. Prof. Dr. Al-Khowarizmi, S.Kom., M.Kom., Halim Maulana, S.T., M.Kom., Dr. Lutfi Basit, S.Sos., M.I.Kom., Dr. Firahmi Rizky, S.Kom., M.Kom., Yoshida Sary, S.E., S.Kom., M.Kom., Martiano, S.Pd., S.Kom., M.Kom., PT. Indonesia Gadai Oke, HRD staff, IT staff, family, friends, and colleagues for their support in completing this research.

The author declares that this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

[1] C. K. Gomathy, M. A. Ramaseshacharyulu, M. C. S. Sarath, and M. A. S. Sreekanth, "Overview of recruitment and selection process in HRM," *Int. J. Sci. Res. Eng. Manag. Vol.*, vol. 6, 2022.

[2] M. I. Hossain, "Software development life cycle (SDLC) methodologies for information systems project management," *Int. J. Multidiscip. Res.*, vol. 5, no. 5, pp. 1–36, 2023.

[3] T. Nasir and A. Ali, "Comparative Analysis Of Software Development Methodologies In The Age Of Software-Defined Machines," in *2024 IEEE 1st Karachi Section Humanitarian Technology Conference (KHI-HTC)*, Ieee, 2024, pp. 1–5.

[4] H. Saeed, I. Shafi, J. Ahmad, A. A. Khan, T. Khurshaid, and I. Ashraf, "Review of Techniques for Integrating Security in Software Development Lifecycle.," *Comput. Mater. Contin.*, vol. 82, no. 1, 2025.

[5] R. Johnson, *Entity-Component System Design Patterns: Definitive Reference for Developers and Engineers*. HiTeX Press, 2025.

[6] E. Ullah, M. M. Baig, H. GholamHosseini, and J. Lu, "Failure mode and effect analysis (FMEA) to identify and mitigate failures in a hospital rapid response system (RRS)," *Heliyon*, vol. 8, no. 2, 2022.

[7] B. Salah, M. Alnahhal, and M. Ali, "Risk prioritization using a modified FMEA analysis in industry 4.0," *J. Eng. Res.*, vol. 11, no. 4, pp. 460–468, 2023.

[8] A. Ghanad, "An overview of quantitative research methods," *Int. J. Multidiscip. Res. Anal.*, vol. 6, no. 08, pp. 3794–3803, 2023.

[9] H. Baharun and R. Hasanah, "Quality Improvement in Increasing Public Trust Using the Failure Mode and Effect Analysis (FMEA) Method," *Tarbawi J. Keilmuan Manaj. Pendidik.*, vol. 9, no. 01, pp. 59–68, 2023.

[10] M. Cai and S. Sun, "Data-driven aviation safety risk assessment: An integrated framework combining FMEA and quantum probability theory," *Inf. Sci. (Ny).*, p. 122689, 2025.

[11] A. C. Moreira, L. M. D. F. Ferreira, and P. Silva, "A case study on FMEA-based improvement for managing new product development risk," *Int. J. Qual. Reliab. Manag.*, vol. 38, no. 5, pp. 1130–1148, 2021.