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Implementation of The Behaviorally Anchored Rating Scale Method for Employee Performance Evaluation of MSMEs in Surabaya City Based on Information Technology

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ABSTRACT

Micro, Small, and Medium Enterprises (MSMEs) in Surabaya encounter persistent challenges in conducting objective employee performance evaluations due to limited resources and the reliance on subjective assessments. To address this issue, this study implements the Behaviorally Anchored Rating Scale (BARS) method supported by information technology to create a more transparent and systematic evaluation process. A web-based open-source application was designed and developed using the ADDIE research and development model, covering the stages of analysis, design, development, implementation, and evaluation. The system integrates essential features, including multi-user login, master data management, performance appraisal modules, event recording, score appeal mechanisms, reporting, and role-based access control (RBAC). System reliability was verified through black box testing, confirming functionality and consistency across all modules. Pilot testing involving several MSME partners demonstrated that the application is user-friendly, objective, and efficient, with an average satisfaction score of 85.5% (4.28 out of 5). Despite these promising results, limitations remain, such as the current reliance on web-based access, limited test coverage across MSMEs, and the focus solely on performance appraisal rather than broader HR functions. Overall, the findings highlight that integrating BARS with information technology not only improves the objectivity and efficiency of employee evaluations in MSMEs but also contributes theoretically to performance management research and practically to enterprise-level decision-making.

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1. INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) are the backbone of the Indonesian economy, including in Surabaya, where they absorb a large workforce across diverse sectors such as food and beverage, crafts, and services. Despite their vital role, MSMEs face persistent challenges in managing human resources, particularly in evaluating employee performance. Performance appraisals are often conducted informally, relying on subjective judgments without standardized indicators. This condition leads to dissatisfaction, reduced motivation, and high employee turnover. Furthermore, due to limited financial resources, managerial expertise, and technological adoption, MSMEs often cannot implement comprehensive performance evaluation systems similar to those used by larger enterprises. These limitations highlight a research gap: the absence of structured, practical, and scalable performance appraisal models tailored specifically for MSMEs.

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Previous studies have introduced the Behaviorally Anchored Rating Scale (BARS) as an approach capable of reducing subjectivity in employee performance evaluation by using behavioral indicators as anchors. However, most applications of BARS have been carried out in medium or large-scale organizations with better resources, while very few studies have examined its applicability in resource-constrained MSME contexts. Moreover, the integration of BARS with digital solutions in the MSME sector remains underexplored. This study therefore offers novelty by adapting BARS into a user-friendly, IT-based application built on open-source technology, designed to be lightweight, cost-effective, and aligned with the operational realities of MSMEs. The system also applies the ADDIE development framework, ensuring structured design, development, and validation of the proposed application.

Accordingly, the objective of this research is to design, develop, and evaluate an MSME-oriented employee performance appraisal application that integrates the BARS method within an IT-based platform. Specifically, the study seeks to: (1) provide a methodological reference for applying behaviorally anchored performance appraisal in small business settings, (2) deliver a practical tool that enhances objectivity, transparency, and efficiency in MSME human resource management, and (3) contribute to the broader discourse on digital transformation of HR practices by offering a model that could potentially be scaled for national adoption.

2. METHOD

This research adopted a Research and Development (R&D) approach using the ADDIE framework (Analysis, Design, Development, Implementation, Evaluation) as the main guideline. The ADDIE model was chosen because it is structured, iterative, and flexible, allowing refinements at each stage to ensure quality of the final product[10] [11]. Within this study, ADDIE served as a systematic guide in designing and developing a BARS-based employee performance evaluation system tailored to the needs of MSMEs [12].

2.1. BARS Framework for Performance Evaluation

The Behaviorally Anchored Rating Scale (BARS) was used as the core method for employee performance assessment. Its application in this research followed four stages:

1. **Preparation**
   Identification of key positions and Key Performance Indicators (KPIs). For each KPI, a behavior anchor table was created to describe observable actions representing performance levels from poor to excellent.
2. **Scaling and Weighting**
   Indicators were rated using a 3-, 5-, or 7-point Likert scale. Weighting was applied to reflect the relative importance of each indicator in line with business priorities.
3. **Assessment and Scoring**
   Employee performance was compared against the defined anchors and scored accordingly. The Total Performance Score (TPS) was calculated using the following equation:
   TPS $= \sum_{i=1}^{n}(W_i \times S_i)$
   Where:
   - SiS_iSi = employee's BARS score for indicator *i*
   - WiW_iWi = weight of indicator *i*, with $\sum \mathrm{W_i} = 1$

   Alternatively, the **weighted mean** was used:

$$Final\ Score = \frac{\sum_{i=1}^{n}(W_i \times S_i)}{\sum_{i=1}^{n} W_i}$$

4. **Analysis**
   The TPS was compared with the organization's performance standards to determine employee categories, serving as the basis for feedback, rewards, or training.

Table1. Performance Rating Scale Conversion Table

Category	Scale 5 (Score)	Scale 3 (Score)
Very Satisfying	≥ 4.5	≥ 2.5
Exceeds Expectations	3.5 – 4.49	2.0 – 2.49
Meets Expectations	2.5 – 3.49	1.5 – 1.99

Category	Scale 5 (Score)	Scale 3 (Score)
Needs Improvement	< 2.5	< 1.5

5. Decisions

Based on the results of the analysis, conclusions can be drawn regarding employee performance and the corresponding actions to be taken, such as the provision of rewards, the implementation of training programs, or the formulation of strategies for performance improvement.

The utilization of open-source Information Technology (IT) simplifies the processes of data collection and processing, thereby reducing the administrative burden faced by MSMEs [9]]. The developed open-source application, equipped with key functional modules, is designed to be adaptable to the specific needs of MSMEs. Furthermore, this application demonstrates the potential to evolve into a nationally applicable model for broader implementation. This study adopts the ADDIE Research and Development approach, which encompasses five systematic stages: analysis, design, development, implementation, and evaluation. This model ensures a structured and iterative process that supports the effective design and validation of the proposed application.

2.2 ADDIE Development Stages

Stage 1: Analysis

At the analysis stage, the research team identified key issues related to employee performance, defined performance appraisal objectives, and conducted field surveys through interviews with several MSME owners in Surabaya. This process included a gap analysis as well as the identification of required data. Functional data encompassed MSME entity records, assessment processes, and reporting mechanisms. Additionally, both software and hardware requirements necessary to support the application were defined.

Stage 2: Design

Based on the findings from the analysis stage, the system design was formulated. Activities included designing the user interface, mapping the workflow for performance evaluation, and developing the BARS assessment scale, commonly structured on a five-point range (from 1 to 5). To ensure data organization and system structure, database modelling was carried out using the Unified Modelling Language (UML).

Stage 3: Development

In the development phase, programming activities were conducted in accordance with the design specifications. A web-based application was developed using the Yii framework. Subsequently, software testing was undertaken, including unit testing, module testing, and integration testing of the BARS assessment module, to ensure functionality and accuracy.

Stage 4: Implementation

Following development, the application was introduced to selected MSMEs for practical use. Implementation involved educational outreach and training sessions to guide users in operating the system effectively.

Stage 5: Evaluation

The evaluation stage consisted of gathering feedback from MSME users and stakeholders regarding the application's usability and effectiveness. Corrective actions were undertaken where necessary, and refinements were made to enhance the functionality, reliability, and overall performance of the system.

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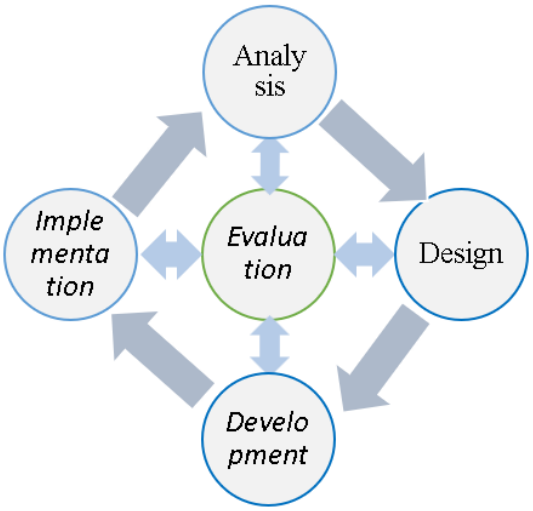

Figure 1. IDDIE Model (Consulta, 2008)

In the developed application, several actors are identified as responsible for executing different activities, namely administrators or company leaders, administrative staff, and employees. The activities that each actor can perform within the system are illustrated in Figure 2 (Use Case Diagram).

The system design emphasizes not only the instructional elements, such as the BARS assessment module, but also the technical aspects of application deployment. The Deployment Diagram illustrates how the BARS backend components—such as rating calculations and data processing—are hosted on a secure server to ensure the confidentiality and privacy of employee data. Meanwhile, the frontend components, including the rating interface (UI), are deployed on user devices for direct interaction.

2.3 System Design and Architecture

Furthermore, the conceptual integration of the ADDIE design stages with their corresponding system architecture is depicted in Figure 3 (Deployment Diagram). This figure illustrates the relationship between the ADDIE development framework, the deployment environment, and the operational functionality of the BARS-based application.
The primary components of the deployment diagram can be described as follows:
1. Database (DB)

The database architecture consists of two layers: the Primary Database, which stores the core data, and the Backup Database, which functions as a redundancy mechanism. The backup process is executed regularly from the Primary DB to the Backup DB to ensure data availability, integrity, and security. This configuration safeguards employee performance records from data loss and minimizes downtime risks, thereby supporting system reliability and business continuity.

2. Server

The server infrastructure operates a web server that is responsible for handling requests originating from client browsers. It serves as the intermediary between the user interface (frontend) and the database (backend). The server communicates with the database through PHP-based protocols, enabling efficient retrieval, processing, and storage of employee performance data. By centralizing operations within the server environment, administrative control, data security, and system performance are effectively maintained.

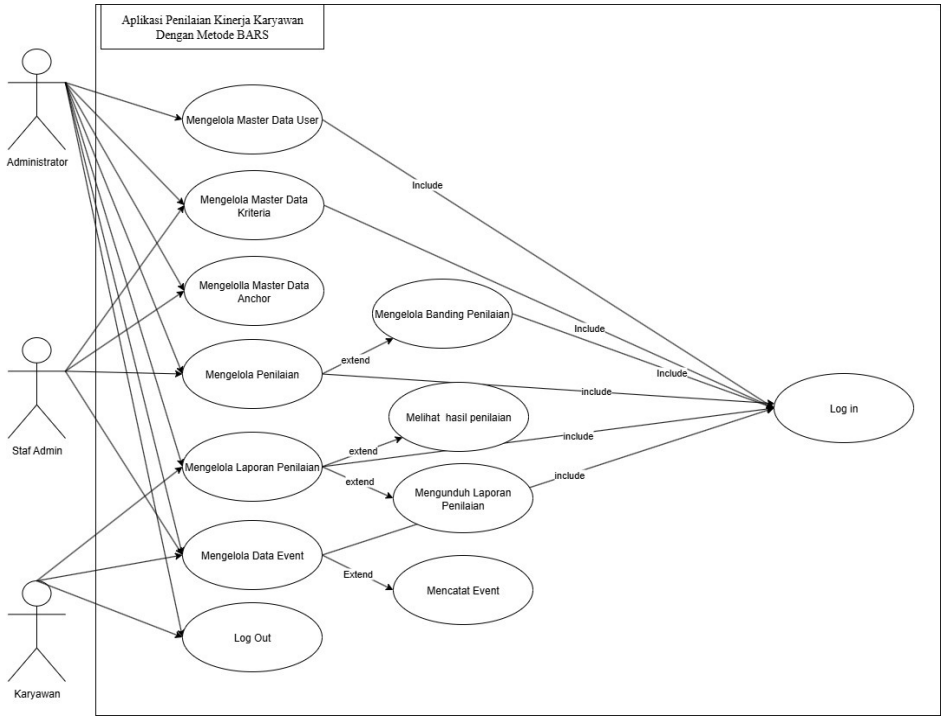

Figure 2. Use Case Diagram

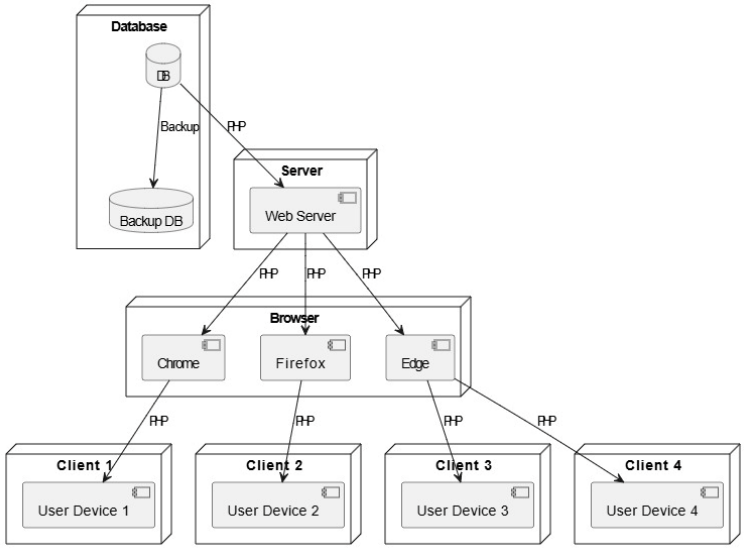

Figure 3. Deploy Diagram

3. The browser acts as an intermediary between the user and the server, sending user requests and receiving responses from the user. The browser used can be Chrome, Firefox, Edge, or another application.
4. Clients (User Devices). Each client (user 1, 2, etc.) can use a browser to access the web server. The client uses the PHP (Hypertext Preprocessor) protocol to connect the browser to the server.

Another application design result is a class diagram. This diagram serves as the basis for application implementation. With a good class diagram, developers can begin the implementation process more easily and efficiently. Figure 4 shows the application's class diagram showing the relationships between classes within the application. This helps understand the data flow and processes involved in the BARS employee performance appraisal system.

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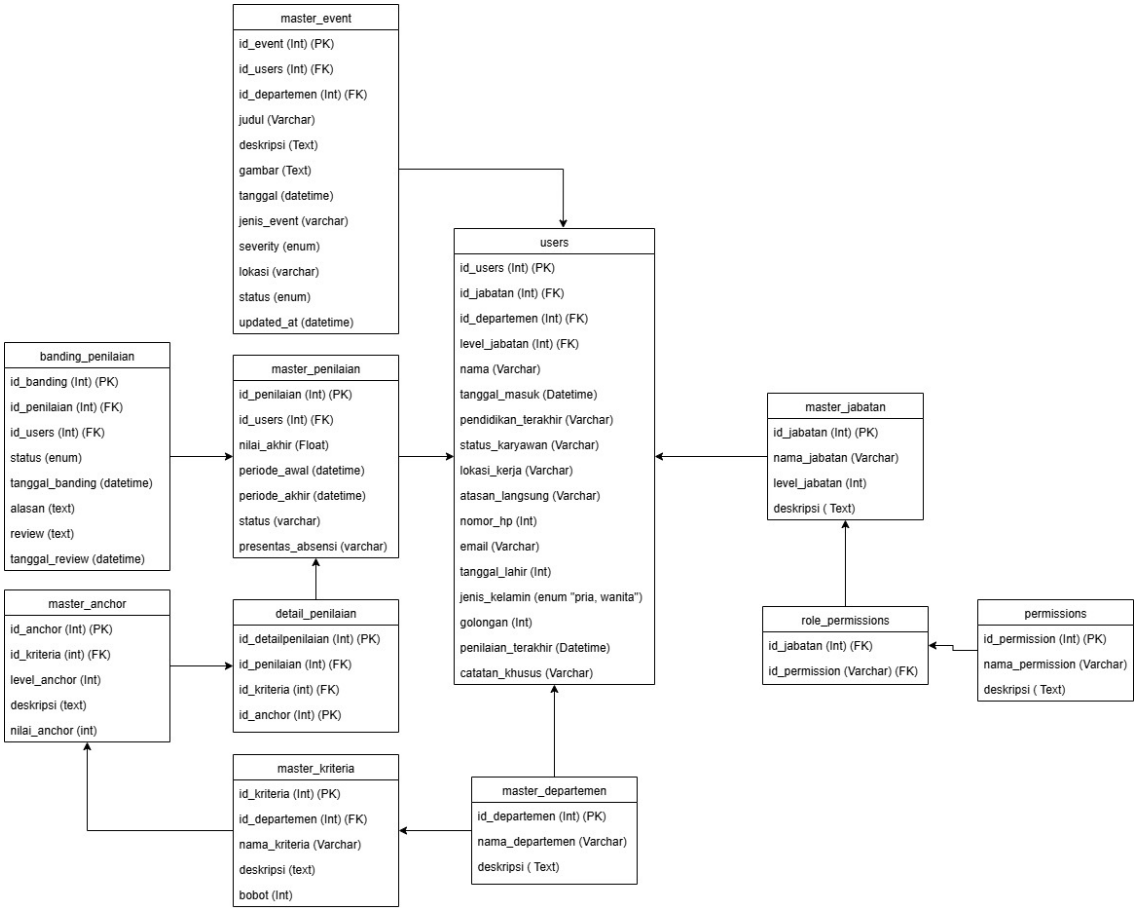

Figure 4. Application Class Diagram

3. RESULTS AND DISCUSSION

Micro, Small, and Medium Enterprises (MSMEs) are widely recognized as the backbone of the Indonesian economy, including the city of Surabaya, which serves as the focus of this study. According to data from the Ministry of Cooperatives and SMEs for 2024–2025, MSMEs operate across diverse sectors such as trade, manufacturing, services, agriculture, and the digital economy. For this research, several MSMEs from different sectors were selected as case samples. These included CV. Diwarna, a producer of socks and embroidered school accessories; IRT Sewing Bynes, a garment producer; PT. Jasmine Smart Solution, a software development company; PT. Erwin Technical Computer, a provider of CCTV and IT-related maintenance and consulting services, and IRT *Warung/Café Kopi Literasi Digital*, representing the food and beverage sector. This diverse sample provided insights into the adaptability of the developed system across various MSME contexts.

In order to develop the **Employee Performance Appraisal Application using the Behaviorally Anchored Rating Scale (BARS)** that has been introduced to MSMEs, this questionnaire is designed to gather feedback on its ease of use, usefulness, and user satisfaction with the appraisal results. Feedback will be used only to improve the application. Through the questionnaire, respondent input data was obtained regarding the use of this application. The questionnaire contained 8 question items for MSME users and the following Likert scale, 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Based on the feedback provided by respondents totaling 5 MSMEs, on the questions provided in the application questionnaire material, the scores obtained were as shown in Table 2.

Table 2. Respondents' feedback on the application

No	Statement	1	2	3	4	5	Persentase
1	The BARS-based performance appraisal application is easy to use (user-friendly).				3	2	88,00%
2	The interface of the BARS application is clear, well-structured, and easy to understand.			2	3		72,00%

3	The process of inputting and storing employee performance data in the BARS application runs smoothly without significant issues.		1	2	2	84,00%
4	The BARS application helps provide more objective and measurable employee performance evaluations compared to manual methods.			1	4	96,00%
5	The appraisal results generated by the BARS application are easy to understand and can be used as a basis for managerial decision-making.	1		1	3	84,00%
6	The BARS application improves the efficiency of the employee performance evaluation process in MSMEs.			3	2	88,00%
7	The reporting features of the BARS application meet the needs of MSMEs.			3	2	88,00%
8	Overall, the BARS application is beneficial for MSMEs in managing and improving employee performance.		1	2	2	84,00%
Average						85,50%

Based on table 2, it shows that this application can be used as a tool to evaluate the performance of MSME employees significantly, with an average score of 85.5% or 4.28 on a Likert scale range of 1 – 5.

The first interface displayed when users access the application is the login form (Figure 5: User Login), which functions as the authentication process. Through this feature, user roles are verified, whether as administrators, staff, or employees, before being granted access to the system. Once login credentials (username and password) are validated, users are directed to the dashboard menu page (Figure 6: Dashboard Menu). The dashboard provides access to the system's core modules, which include master data (e.g., user records and performance criteria), the performance assessment process, event documentation, and appeal management. These modules are designed not only to facilitate smooth navigation but also to support transparency, accountability, and efficiency in performance evaluations.

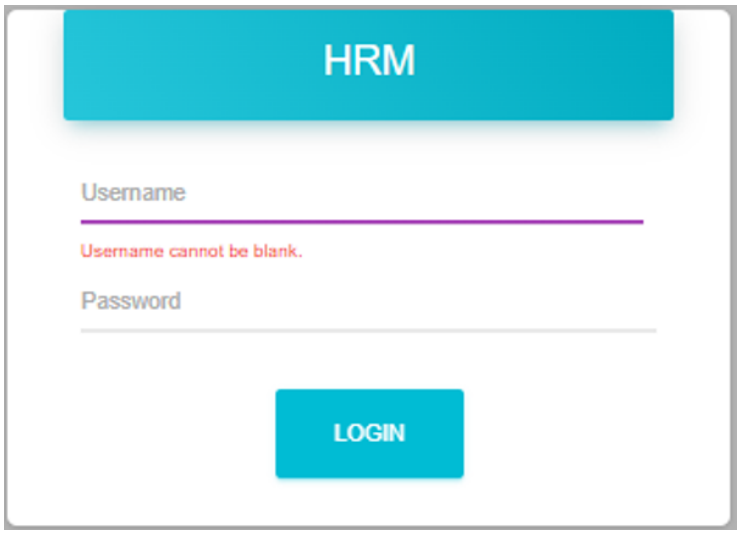

Figure 5. User Login

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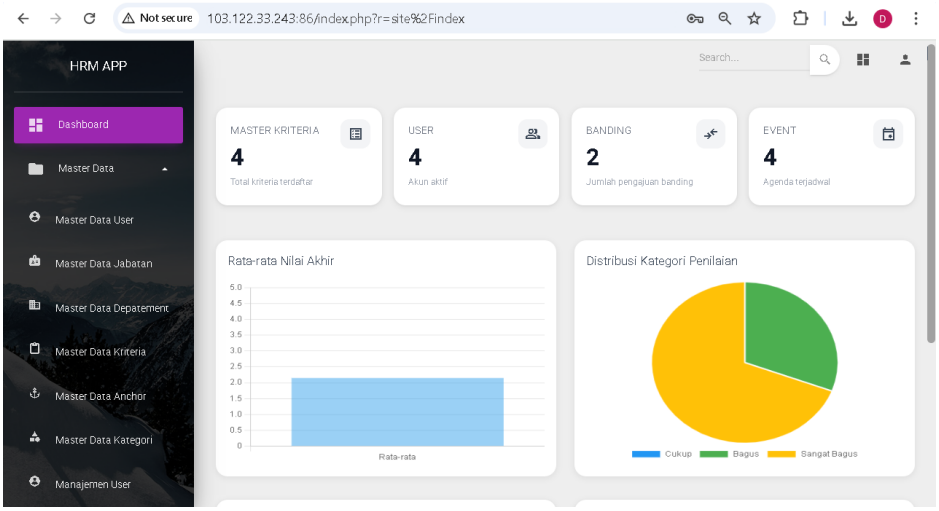

Figure 6. Dashboard Menu

The Master Menu serves as the foundation of the application's data management system. It is used to create and maintain data tables, which are categorized into four primary modules: Master Data Module – consisting of user records, organizational positions, departments, performance criteria (indicator dimensions), behavior anchors, and assessment management categories; Assessment Module – encompassing assessment data and reports; Event Module – containing records of events relevant to employees and their performance contexts; and Appeal Module – storing performance assessment data alongside appeals submitted by employees regarding their evaluation results.

Among these features, the critical components are the Master User and Master Criteria, illustrated in Figure 7 (Employee Master Data) and Figure 8 (Criteria Master Data). Through the Master User function, employee information is recorded and categorized by department. In the case of UMKM Diwarna, sample entries included employees from the production, marketing, and finance departments. At this early stage, other departments, such as design, quality control, and warehouse, were not yet included in the dataset.

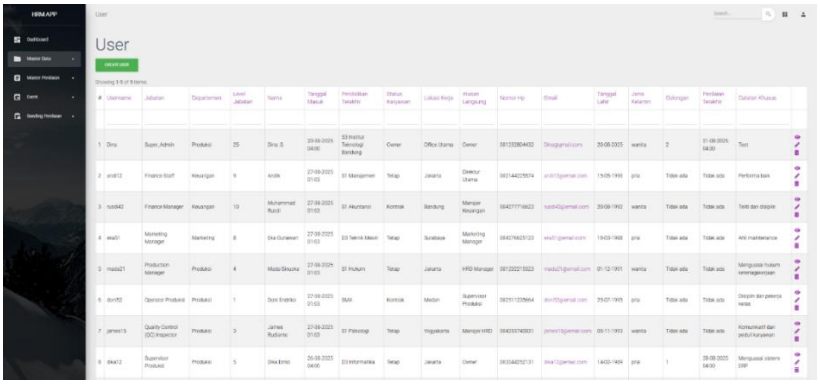

Figure 7. Master of Employee

Performance assessments within the developed system are generally conducted using a 1–5 scale; however, for simplicity and efficiency, this scale can also be adjusted to a 1–3 range depending on the needs of the MSME. Several performance dimensions remain particularly relevant for evaluating MSME employees through the BARS method [13]. These dimensions include:

1. Work Competence – Evaluates the extent to which employees can perform their assigned tasks effectively in accordance with job specifications and organizational needs.
2. Adaptability – Given the dynamic and resource-constrained nature of MSMEs, employees are frequently required to handle multiple responsibilities. As such, their capacity to adapt to change is a critical performance dimension.
3. Initiative and Creativity – MSMEs depend heavily on employees who can take initiative and generate innovative ideas that directly contribute to the growth and competitiveness of the business.
4. Teamwork – Even within smaller organizational structures, collaboration is essential to achieving common goals. Measuring teamwork ensures that employees demonstrate cooperative behavior and contribute to collective success.
5. Customer Orientation – Strong customer focus is vital for MSME sustainability. Evaluating this dimension ensures that employee behavior aligns with efforts to improve product quality and service delivery, thereby enhancing customer satisfaction.
6. Responsibility and Discipline – Reliability in fulfilling assigned duties and adherence to organizational rules and procedures are fundamental traits that directly influence MSME efficiency, credibility, and performance outcomes.

Figure 8, the Master of Criteria, contains several criteria entries for both general and specific indicators related to employee behavior in their department. The scale for each criterion in the performance assessment is optional: 5 or 3.

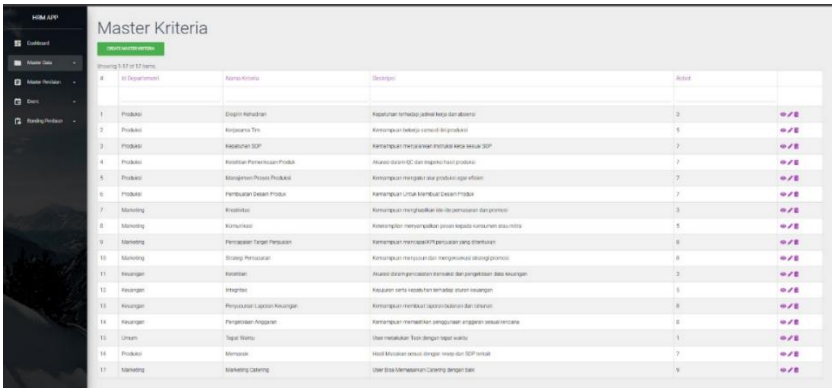

Figure 8. Master of Criteria

The application supports the use of two different rating scales; however, the behavioral anchors assigned to each score must remain consistent to ensure comparability and eliminate bias. For example, a three-point scale described as 1 = Very Poor Performance, 2 = Fair Performance, and 3 = Very Good Performance should correspond proportionally to a five-point scale, such as 1 = Very Poor Performance, 3 = Fair Performance, and 5 = Very Good Performance. This alignment guarantees that both scales may be applied simultaneously or interchangeably without distorting the meaning of the assessments.

During the pilot implementation, employee performance assessments were conducted using the five-point scale across all dimensions (criteria). To enhance the accuracy and relevance of the evaluation process, each dimension was not assigned equal weight. Instead, relative weighting was applied to reflect the varying importance of each criterion for the specific MSME context. This weighting system ensured that critical dimensions—such as adaptability or customer orientation for service-based MSMEs—exerted proportionally greater influence on the final performance score. In addition, the manual calculation process for performance results is presented in the employee performance report (Figure 9), serving both as a verification tool and as a reference for the automated BARS-based evaluation procedure.

$$\text{Final score} = \frac{\sum_{i=1}^{n}(W_i \times S_i)}{\sum_{i=1}^{n} W_i} = \frac{3x2+5x3+8x1+8x3}{3+5+8+8} = \frac{53}{24} = 2{,}21 \quad (3)$$

Based on the assessment category, a score of 2.21 < 2.25 is included in the category "Needs Improvement" as in figure 9. Employee Performance Appraisal Report.

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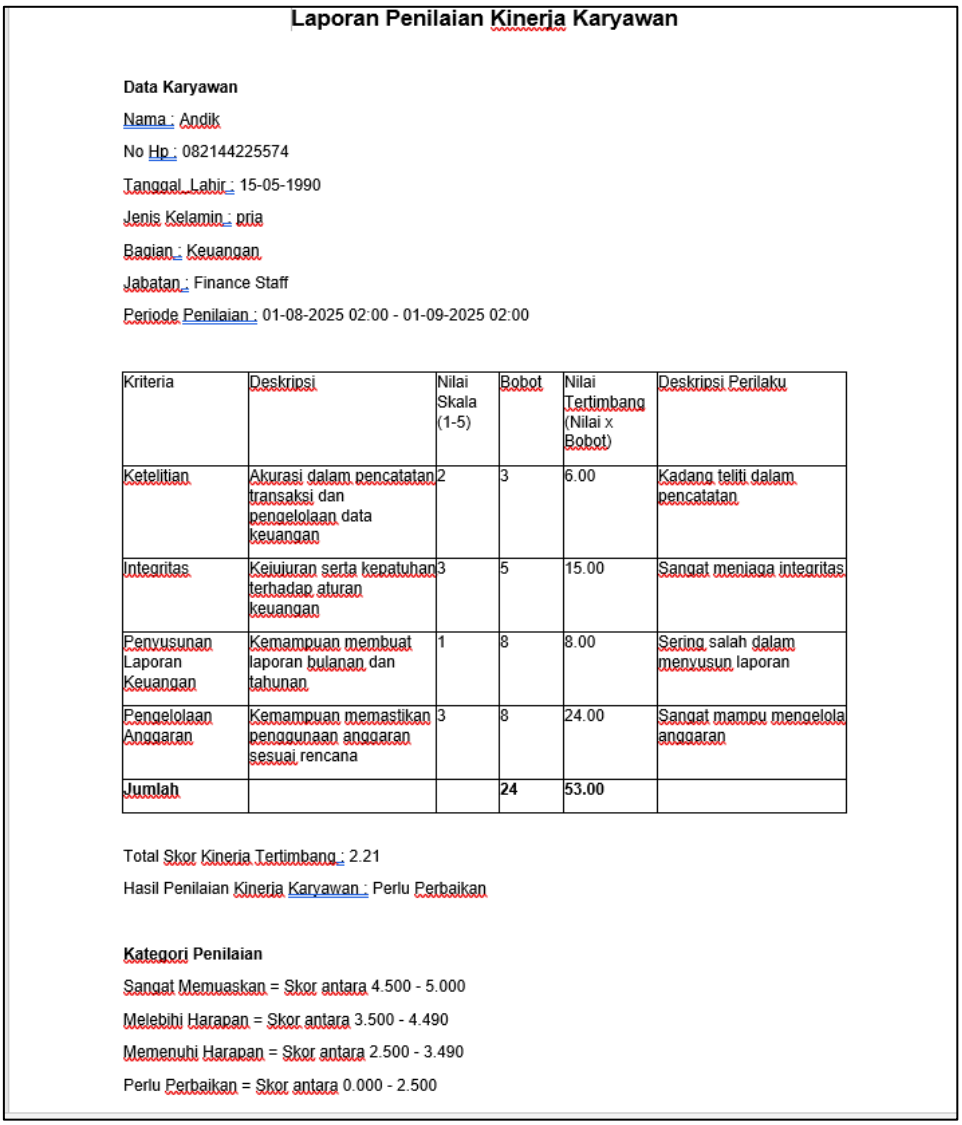
Based on the employee performance appraisal reports, supervisors or MSME leaders are expected to provide recommendations in the form of constructive feedback and to create opportunities for improvement. This ensures that evaluation results are not only used for measurement but also translated into actionable strategies for employee development.

Following application implementation, system reliability was validated through black-box testing. This phase of testing involved executing the application using predefined test data and systematically observing whether the outcomes matched the expected results. Functional performance was assessed across several aspects, including application validity, user interface interaction, data formatting, file access, system performance, initialization, and termination processes.

The testing results confirmed that all core functions operated as intended, with no significant or critical errors detected. This indicates that the system performs reliably under normal usage conditions, meeting both functional and usability requirements. A summary of the test scenarios and their corresponding results is presented in Table 1 [14].



Laporan Penilaian Kinerja Karyawan

Data Karyawan

Nama : Andik

No Hp : 082144225574

Tanggal Lahir : 15-05-1990

Jenis Kelamin : pria

Bagian : Keuangan

Jabatan : Finance Staff

Periode Penilaian : 01-08-2025 02:00 - 01-09-2025 02:00

Kriteria	Deskripsi	Nilai Skala (1-5)	Bobot	Nilai Tertimbang (Nilai x Bobot)	Deskripsi Perilaku
Ketelitian	Akurasi dalam pencatatan transaksi dan pengelolaan data keuangan	2	3	6.00	Kadang teliti dalam pencatatan
Integritas	Kejujuran serta kepatuhan terhadap aturan keuangan	3	5	15.00	Sangat menjaga integritas
Penyusunan Laporan Keuangan	Kemampuan membuat laporan bulanan dan tahunan	1	8	8.00	Sering salah dalam menyusun laporan
Pengelolaan Anggaran	Kemampuan memastikan penggunaan anggaran sesuai rencana	3	8	24.00	Sangat mampu mengelola anggaran
Jumlah			**24**	**53.00**	

Total Skor Kinerja Tertimbang : 2.21

Hasil Penilaian Kinerja Karyawan : Perlu Perbaikan

Kategori Penilaian

Sangat Memuaskan = Skor antara 4.500 - 5.000

Melebihi Harapan = Skor antara 3.500 - 4.490

Memenuhi Harapan = Skor antara 2.500 - 3.490

Perlu Perbaikan = Skor antara 0.000 - 2.500

Figure 9. Employee Performance Appraisal Report

Table 1. Application Black Box Testing

No.N	Activity	Test Case	Testing Scenario	Expected Result	Status
1	Login	Perform correct login	Enter username and password	Notification of successful login appears and enters the system dashboard	Valid
		Perform incorrect login	Enter username and password	Notification of failed login appears and returns to main login page	Valid
2	Manage user data	Add user data	Enter user data	User data successfully saved into database	Valid
		Edit user account data	Select user data to be edited	Updated user data successfully edited	Valid
		Display user data	User data displayed in User Master	User data successfully displayed in User Master	Valid
		Delete user account	Select user data to be deleted	User data successfully deleted from database	Valid
3	Manage Assessment Criteria Data	Add Assessment Criteria data	Enter Assessment Criteria data into Assessment Criteria form	Assessment Criteria data successfully saved into database	Valid
		Display Assessment Criteria data	Assessment Criteria data displayed on assessment page	Assessment Criteria data successfully displayed on add weight page	Valid
		Edit Assessment Criteria data	Select Assessment Criteria data to be changed, then save	Updated Assessment Criteria data successfully saved	Valid
4	Manage Anchor and Value data	Add Anchor and Value data	Enter data into Anchor form	Anchor and Value data successfully saved into database	Valid
		Edit Anchor and Value data	Select Anchor and Value data to be edited and enter new data into form	New Anchor and Value data successfully edited	Valid
		Delete Anchor and Value data	Select Anchor and Value data to be deleted	Anchor and Value data successfully deleted from database	Valid
		Display Anchor and Value data	Indicator data displayed on Anchor and Value page	Indicator data successfully displayed on Anchor and Value page	Valid
5	Manage Assessment Report data	Display assessment report data	Assessment report data in database successfully displayed on assessment report page	Assessment report data successfully displayed on assessment report page	Valid
		Display Historical Assessment Chart	Historical Assessment Chart runs and data is correct	Historical chart and data displayed correctly	Valid
6	Conduct Performance Assessment	Input Performance Assessment	Performance Assessment data successfully displayed on Performance Assessment page	Performance Assessment data successfully displayed on assessment report and Performance Assessment page	Valid
		Edit Performance Assessment data	Select Performance Assessment data to be edited and enter new data into form	Updated Performance Assessment data successfully edited	Valid
		Delete Performance Assessment data	Select Performance Assessment data to be deleted	Performance Assessment data successfully deleted from database	Valid
		Display Criteria, Anchor, Criteria	Criteria, Anchor, and Criteria displayed when user performs assessment	Criteria, Anchor, and Criteria from database displayed in dropdown menu	Valid
		Display Status Data	Status data displayed according to predetermined maximum and minimum values	Status data successfully displayed and correct	Valid
7	Manage Event	Input event data	Event data successfully displayed on event page	Event data successfully displayed on assessment report and event page	Valid

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		Edit event data	Select event data to be edited and enter new data into form	Updated event data successfully edited	Valid
		Delete event data	Select event data to be deleted	Event data successfully deleted from database	Valid
8	RBAC Feature (Role-Based Access Control)	Add Permission to Role	Permission recorded in database and user can access the page	Data stored in database and user can access the page	Valid
		Delete Permission from Role	Permission deleted in database and user cannot access the page	Data deleted from database and user no longer has access	Valid
		Page Access	User with Permission can access the page	User can access the page if permission is given	Valid

4. CONCLUSION

This study confirms the successful integration of the Behaviorally Anchored Rating Scale (BARS) into an IT-based performance appraisal application tailored for MSMEs, demonstrating that the system is functional, objective, and efficient in supporting employee evaluation. Developed using the ADDIE framework and implemented as a web-based open-source solution, the application incorporates key features such as multi-user login, master data management, performance scoring, event recording, score appeal mechanisms, reporting, and role-based access control (RBAC). The results of black box testing and pilot trials with MSME partners indicate that all modules performed reliably, with user feedback reporting a high satisfaction score of 85.5% (4.28/5), reflecting both ease of use and transparency of the system. Nevertheless, limitations remain, including the reliance on a web-based platform that is less optimal for mobile-first users, limited sample size that does not fully represent the diversity of MSME sectors, and the focus solely on performance evaluation without broader HR functions. Future research should therefore expand testing across wider MSME contexts, integrate additional HR modules, and develop a mobile-based version to further improve accessibility, scalability, and adoption at the national level.

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