Training Recommendation Using Simple Addictive Weighting In Agriculture Product Trading Company

Mayang Ayu Andila[1], Raymond Sunardi Oetama[2*]

[1,2] Department of Information Systems, Faculty of Engineering & Informatics,
Universitas Multimedia Nusantara, Tangerang, Banten 18511, Indonesia
[*]Corresponding Author:
Email: raymond@umn.ac.id

Abstract.

The use of System Application and Processing (SAP) software is becoming increasingly popular among businesses, and ensuring employees receive adequate training is essential for effective use. However, there are common problems associated with SAP training, such as the lack of adequate training materials, training module quality, insufficient training facilities, and inadequate coach quality. These problems can result in employees not receiving the training they need to operate the software effectively, leading to a lack of productivity and efficiency in the workplace. To address these issues, the development of a training recommendation application using XAMPP, HTML, PHP, and CSS has been successful. The application offers an integrated, secure, and accurate solution to select the most appropriate SAP Training Module for each employee based on their performance across different attributes. The User Acceptance Testing (UAT) carried out with the Human Resource staff showed that the application built using the Simple Additive Weighting (SAW) method was 100% effective in selecting the best module for each employee. The SAW method considers the weighted sum of performance rankings for each module, providing a reliable and accurate recommendation for the most suitable module for each employee.

Keywords: *SAP Training, Simple Additive Weighting, Training Recommendation Application, And User Acceptance Testing.*

I. INTRODUCTION

Companies try to gain a competitive edge by meeting rising competition through worldwide growth. As a result, Enterprise Resource Planning (ERP) has become a crucial tool for businesses to gain a competitive edge [1]. ERP is an integrated, flexible, and changeable information system that streamlines business operations by centralizing data from throughout the firm [2]. System Application and Processing (SAP) is an ERP product. To ensure successful job performance on SAP implementation, organizations must design effective training programs that provide employees with the necessary knowledge and skills to perform their duties and responsibilities [3]. These training programs should be tailored to the specific needs and requirements of each job position and task and should be designed to ensure that employees are fully equipped to meet the demands of their new roles.This scenario is also applicable to the SAP system used by the company in this study. Based on the results of interviews, several obstacles are felt by users when using the SAP system, the first obstacle is that new users who have never used the SAP system find adjusting to the method challenging. Because it takes experience and an understanding of theory when using the SAP system [4]. For this purpose, the Company plan to arrange training for its employees to be ready to apply for SAP.Training for employees refers to the process of teaching or providing instruction to employees to enhance their skills, knowledge, and abilities to perform their job duties more effectively [5]. Employee training can cover a wide range of topics, such as job-specific skills, safety procedures, customer service, leadership, communication, and more [6].

Effective employee training can improve job performance, increase productivity, reduce errors and accidents, boost employee morale and job satisfaction, and enhance the overall performance of an organization [7].While employee training can bring many benefits to an organization, there can also be some challenges or potential problems associated with it. First, problems in training materials can have a significant impact on the effectiveness of training programs [8]. Inadequate training materials can also result in inconsistent training outcomes and lower employee engagement. Secondly, the quality of SAP training modules can be a problem due to outdated or irrelevant content, insufficient detail or explanation, and a lack

of hands-on practice opportunities [9]. Inadequate training pace and limited availability of experienced trainers in some areas can also impact the effectiveness of the training program and the success of the organization's SAP implementation. Third, organizations may also face challenges with the SAP training facility. One common problem is the lack of adequate resources, such as computers and software [10]. This can lead to a crowded or disorganized learning environment, causing distractions and hindering the ability of learners to focus. And finally, organizations may face in SAP training the quality of the coaches. Some coaches may lack the necessary knowledge and experience in SAP to effectively teach the material, leading to a subpar learning experience for employees [11]. It will make it difficult for learners to understand and retain the information being presented.

II. METHODS

2.1 Research Object

The Company in this study engages in the trading of agricultural products. It was established in 1975 and has since been committed to serving the needs of its customer partners across the country with its expertise, strength, and comprehensive distribution network infrastructure. It is one of the parent companies that sell frozen food, including feed, chicken meat production, animal protein, and animal health products. Its primary business activity involves obtaining products from the parent company and distributing them to end consumers. Its food and beverage products are marketed predominantly in the Jabodetabek region and several areas on Java Island.

2.2 Data Collection

In this research, data is collected through various methods to ensure a comprehensive analysis. Firstly, observation is utilized to gather information about the subject matter through direct observation of its behaviors or characteristics. Secondly, interviews are conducted to obtain insights from relevant individuals with specialized knowledge or experience related to the subject matter.

2.3 Research Flow

As shown in Fig. 1, the Rapid Application Development (RAD) technique is divided into four separate phases: requirement planning, user design, construction, and cutover [12]. The first step is working closely with stakeholders to identify the software application's user needs. The User Design phase then focuses on generating prototypes, tests, and refinement to match the system design with user demands using UML. The Unified Modeling Language (UML) is a widely used industry standard for modeling and visualizing system development projects [13]. The Construction phase develops the system's functional features, including the HTML user interface with PHP programming and the MySQL database using XAMPP. Finally, the Cutover phase ensures that the program runs consistently and satisfies the objectives and requirements supplied by stakeholders. To validate the system's operation and usability, Black Box Testing will be employed, followed by User Acceptance Testing (UAT). The final software application is built to fulfill user goals and specifications while maintaining functionality and usability using the RAD methodology's systematic and iterative approach.

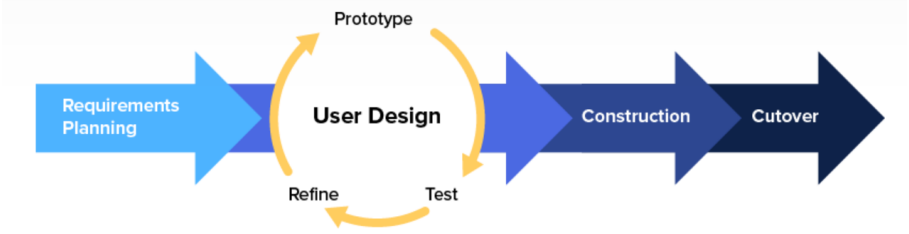

Fig 1. RAD Phases [14]

2.4. Data Analysis Method

Simple Additive Weighting (SAW) is a widely used decision-making technique in decision-support systems that can handle problems with multiple attributes [15]. Its core principle is to compute the weighted sum of performance rankings for each alternative across all attributes. Ensure the comparability of different alternative rankings, it involves normalizing the decision matrix.

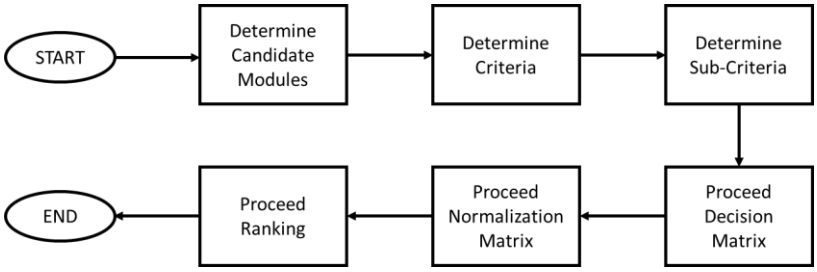

Fig 2. SAW Processes

The process described in Fig. 2 is a framework for decision-making used to determine the most suitable modules for the training in the Company. Firstly, the process begins with identifying potential candidate modules. Next, the criteria and sub-criteria for the selection process must be established. Afterward, a decision matrix is created, which involves evaluating each candidate module against the established criteria and sub-criteria to determine their strengths and weaknesses. The matrix is then normalized to ensure fairness and consistency in the evaluation process. Finally, the candidates are ranked based on their scores, and the most suitable candidate is selected for the position.There are two types of criteria in the SAW method, namely the calculation of benefit criteria and the calculation of cost criteria. For normalization of values, if the criteria are of the cost type, the formula used is:

$$r_{ij} = \frac{Min(X_{ij})}{X_{ij}} \quad (1)$$

When the criteria are of the benefit type, the formula utilized is:

$$r_{ij} = \frac{X_{ij}}{Max(X_{ij})} \quad (2)$$

The next step is the process of calculating the preference value (V) using the following equation:

$$V_{ij} = \sum_{j=1}^{n} w_j r_{ij} \quad (3)$$

After the preference value for each alternative has been calculated, the next step is to rank them. The ranking process is done by sorting the preference values in descending order so that the solution is obtained from the highest value which is chosen as the best alternative.

III. RESULTS AND DISCUSSION

3.1 Requirement Planning

Based on the results of an interview with the Human Resources staff of the Company, the current training system does not have a specific training system. Training is conducted every time there is a policy change in the company, where all SAP system users must participate in the training process together and at the same time. There are many factors to determine whether the training is successful or not, such as the training material, the quality of the trainer in delivering the material, the facilities during the training, and the quality of the module. Therefore, the recommended system created for the decision support system website aims to determine whether a user needs to be retrained or not. This is intended to assist the company in identifying SAP system user employees who have not yet mastered certain modules during training.

3.2 User Design

In addition, Fig. 3 shows the Use case Diagram of the Training Recommendation Application. The system consists of one role, namely an admin role. The admin role is used to manage the training modules, criteria, and sub-criteria. The Admin can also determine decisions by assigning weights and viewing the results.

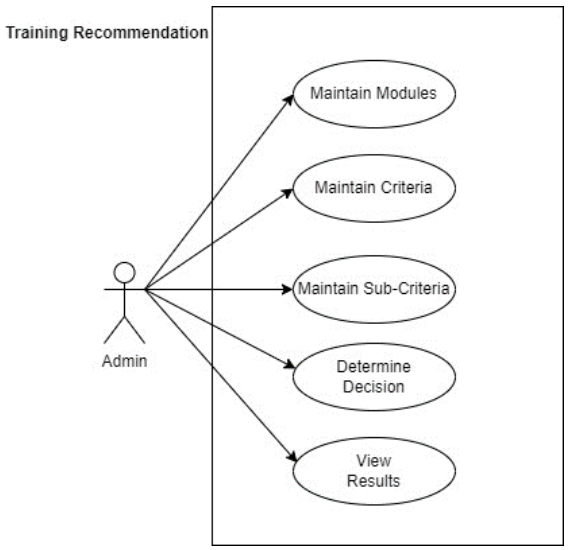

Fig 3. Use Case of Training Recommendation Application

3.3 Construction

During the construction phase, the actual software application is built. This involves developing the HTML user interface, which allows users to interact with the system, using the PHP programming language. Additionally, the database management system, in this case, the MySQL database, is run using XAMPP. The upcoming discussion explains the outcome of the SAW calculation on the training recommendation.

3.3.1 Determine Candidate Modules

In this study, there will be three candidate modules, which include Sales and Distribution, Financial and Accounting, and Human Capital Management. The sales and Distribution module is primarily concerned with managing customer transactions and interactions, including sales orders, deliveries, and invoices. It also includes functionality for pricing, billing, and credit management. The Financial and Accounting module manages financial transactions and accounting processes such as general ledger accounting, accounts receivable, accounts payable, asset accounting, and bank accounting. It also includes functionality for financial reporting and analysis. The Human Capital Management module is focused on managing an organization's human resources, including employee records, payroll, benefits administration, time management, and talent management. It also includes functionality for workforce planning, recruiting, and performance management [16].

3.3.2 Determine Criteria

Table 1 presents four criteria (C1, C2, C3, C4) along with their respective descriptions and types, which are all benefits-based. Notably, there are no cost-based criteria included in the table. The weight assigned to each criterion in the training recommendation application is 0.4 for C1, 0.3 for C2, 0.2 for C3, and 0.1 for C4. These weights represent the overall importance of each criterion in the decision-making process. Here's a breakdown of each criterion:

- Training Material (C1): This criterion refers to the quality and effectiveness of the training materials used in a particular training program. The benefit of having good training material is that it can help learners better understand and retain the information being taught, leading to a more successful and productive training experience.
- Quality Module (C2): This criterion refers to the overall quality and relevance of the modules or lessons included in a training program. Having high-quality modules can help ensure that learners are acquiring the necessary knowledge and skills to achieve their goals and be successful in their roles.
- Training Facilities (C3): This criterion refers to the physical training environment, such as the classroom or training room, and the amenities available to learners during the training. The benefit of having good training facilities is that it can create a more comfortable and conducive learning environment, which can lead to better retention of information and a more enjoyable training experience.

- Coach Quality (C4): This criterion refers to the quality of the trainers or coaches delivering the training. Having high-quality coaches can help ensure that learners receive the guidance and support they need to succeed in their roles and achieve their goals. Good coaches can also provide valuable feedback and insights to help learners improve their performance.

Table 1. Criteria in Training Recommendation Application

No.	Criteria		
	Code	**Description**	**Type**
1	C1	Training Materials	Benefit
2	C2	Quality Modules	Benefit
3	C3	Training Facilities	Benefit
4	C4	Coach Quality	Benefit

3.3.3 Determine Sub-Criteria

The detailed weights for each sub-criterion will be provided in the subsequent discussion, which will give a more comprehensive understanding of how the final scores are calculated in the system. The weights reflect the priorities of the organization or the decision-maker, and they are used to ensure that the system considers the relative importance of each criterion when generating recommendations.Table 2 provides a breakdown of the five levels of completeness of training material and their corresponding weights. Incomplete training material is likely to be missing important information and has the lowest weight of 0.1, indicating that it is not very effective in achieving learning outcomes. The less complete training material is somewhat developed but still lacking in key areas, with a slightly higher weight of 0.2. Quite complete training material is well-developed and covers most necessary topics, with a weight of 0.3. Complete training material is comprehensive and covers all necessary topics, making it highly valuable with a weight of 0.7. Finally, very complete training material goes above and beyond what is necessary, with a weight of 0.8, indicating that it can significantly enhance the learning experience.

Table 2. Training Materials Criteria in Training Recommendation Application

No	Training Material	Weights
1	Incomplete	0.1
2	Less complete	0.2
3	Quite complete	0.3
4	Complete	0.7
5	Very Complete	0.8

Table 3 presents five modules with different levels of completeness and weights. Modules 1 and 2 are incomplete with weights of 0.1 and 0.2, respectively. Module 3 is mostly complete with a weight of 0.3, while modules 4 and 5 are complete with weights of 0.7 and 0.8, respectively.

Table 3. Module Quality Criteria in Training Recommendation Application

No	Module Quality	Weights
1	Incomplete	0.1
2	Less complete	0.2
3	Quite complete	0.3
4	Complete	0.7
5	Very Complete	0.8

Table 4 shows five training facilities with varying levels of completeness and their corresponding weights. Facility 1 is incomplete and weighs 0.1, indicating that it is not yet fully developed or lacks essential features. Facility 2 is less complete but slightly better, with a weight of 0.2. Facility 3 is quite complete with a weight of 0.3, indicating that it has most of the necessary components and features, but may still require some improvements. Facility 4 is complete with a weight of 0.7, meaning that it has all the essential components and functions required for training purposes. Finally, Facility 5 is very complete with a weight of 0.8, suggesting that it is highly advanced and fully operational, with all the necessary features and components required for effective training.

Table 4. Training Facilities Criteria in Training Recommendation Application

No	Training Facilities	Weights
1	Incomplete	0.1
2	Less complete	0.2
3	Quite complete	0.3
4	Complete	0.7
5	Very Complete	0.8

Table 5 shows five coach categories with their corresponding weight, indicating their level of clarity. The categories range from "Very Unclear" with a weight of 0.1 to "Very Clear" with a weight of 0.8. They indicate increasing levels of communication skills and effectiveness in providing guidance and instructions.

Table 5. Coach Quality Criteria in Training Recommendation Application

No	Coach Quality	Weights
1	Very Unclear	0.1
2	Unclear	0.2
3	Quite clear	0.3
4	Clear	0.7
5	Very clear	0.8

3.3.4 Proceed Decision Matrix

Table 6 presents qualitative evaluations of three candidate modules - Sales and Distribution, Financial and Accounting, and Human Capital Management - based on four criteria. For Sales and Distribution, C1 is rated as "Quite complete," C2 as "Less complete," C3 as "Incomplete," and C4 as "Quite clear." Financial and Accounting are rated as "Incomplete" for both C1 and C2, while C3 and C4 are rated as "Incomplete" and "Very unclear," respectively. Human Capital Management, on the other hand, receives high ratings across all criteria with "Complete," "Quite complete," "Very complete," and "Very clear" for C1, C2, C3, and C4, respectively.

Table 6. Qualitative Evaluation of Training Recommendation Application

Candidate Module	C1	C2	C3	C4
Sales and Distribution	Quite complete	Less complete	Incomplete	Quite clear
Financial and Accounting	Incomplete	Incomplete	Incomplete	Very Unclear
Human Capital Management	Complete	Quite complete	Very Complete	Very clear

Table 7 represents the decision matrix with qualitative values from Table 6 being transformed into numerical values that correspond to their sub-criteria weights. The assigned weightings for each criterion (C1, C2, C3, C4) for every candidate module (Sales and Distribution, Financial and Accounting, and Human Capital Management) represent the relative importance of each criterion for its corresponding module.

Table 7. Decision Matrix of Training Recommendation Application

Modul	C1	C2	C3	C4
Sales and Distribution	0.3	0.2	0.1	0.3
Financial and Accounting	0.1	0.1	0.1	0.1
Human Capital Management	0.7	0.3	0.8	0.8

3.3.5 Proceed Normalization Matrix

Table 8 illustrates the normalization matrix, which is a table that shows the normalized values of the four criteria for the three candidate modules - Sales and Distribution, Financial and Accounting, and Human Capital Management. The normalization process involves converting the raw data of each criterion into a scale of 0 to 1, where 1 represents the best value and 0 represents the worst. In this table, only formula 1 is applied since all criteria are beneficial. Formula 1 is a simple scaling method that involves dividing each criterion's raw score by the sum of all raw scores for that particular module. The resulting quotient represents the criterion's contribution to the module's overall performance score.

Table 8. Normalization Table of Training Recommendation Application

Modul	C1	C2	C3	C4
Sales and Distribution	0.42	0.67	0.12	0.37
Financial and Accounting	0.14	0.33	0.12	0.12
Human Capital Management	1	1	1	1

3.3.6 Proceed Ranking

The ranking step is an essential part of the training recommendation application, where the preference values are calculated using formula 3 and the overall weight for each criterion. Table 9 shows the Ranking Results of the SAW preference value calculation. The SAW method results in the smallest value of preference value for the Financial Accounting Module compared to the other two modules as Rank 1, indicating that it is the worst candidate module for employee training. As a result, the training module that is needed first to be arranged is the Financial Accounting Module.

Table 9. Ranking Results

Modul	Preference Value	Rank
Sales and Distribution	0.43	2
Financial and Accounting	0.191	1
Human Capital Management	1	3

3.4 Cutover

Functional testing is an essential aspect of software testing that helps ensure the effectiveness and usability of a software system. This type of testing involves observing the external behavior of software entities as if they were a "Black Box," and testing all available buttons and functionalities on the display. The goal of functional testing is to ensure that the software functions correctly and performs as intended, thus identifying any issues with the system's external behavior, and enabling software developers to make necessary improvements. By conducting functional testing, software developers can enhance the overall quality and usability of the software system. Table 10 provides an overview of the features of the training recommendation application and their status in meeting user requirements and expectations. The application allows users to maintain modules, criteria, and sub-criteria by adding, editing, or deleting them, and the testing results show that these features have passed the testing criteria. Users can also determine the decision by entering and editing qualitative evaluations, and the results can be displayed correctly in the ranking. The application 100% successfully meets the user requirements and expectations, providing a reliable and effective solution for maintaining, evaluating, and displaying the results.

Table 10. User Acceptance Test of Training Recommendation Application

Features	User Requirements	Expectation	Status
Maintain Modules	Add new module	A new module is successfully added	Pass
	Edit Module	The module is successfully edited	Pass
	Delete module	The module is successfully deleted	Pass
Maintain Criteria	Add new Criterion	New Criterion is successfully added	Pass
	Edit Criterion	Managed to edit the criterion	Pass
	Delete Criterion	Managed to delete the criterion	Pass
Maintain Sub-Criteria	Add new Sub-Criterion	New Sub-Criterion is successfully added	Pass
	Edit Sub-Criterion	Managed to edit the sub-criterion	Pass
	Delete Sub-Criterion	Managed to delete the sub-criterion	Pass
Determine	Entering Qualitative	Qualitative Evaluation can	Pass

Decision	Evaluation	be entered successfully	
	Editing Qualitative Evaluation	Qualitative Evaluation can be edited successfully	Pass
View Results	Ranking Results can be displayed	Ranking Results can be displayed correctly	Pass

IV. CONCLUSION

The training recommendation application was developed using XAMPP, HTML, PHP, and CSS, and it was tested with the Human Resource staff during User Acceptance Testing (UAT). The results of the UAT showed that the application built using the SAW method was successful and could 100% run well. The application can help Human Resource staff in selecting the most suitable SAP Training Module by ranking them based on their performance across different attributes. The SAW method is used to calculate the weighted sum of performance rankings for each module, which can help the staff to identify the best module that suits their needs.

The suggestion to extend the training recommendation system to find the profile of employees that match the training refers to incorporating an employee profiling feature into the system. This feature would involve collecting data on the skills, competencies, and experience of individual employees and using that data to generate personalized training recommendations that align with their career goals and development needs. By incorporating this feature, the system can provide more targeted and effective training recommendations, as each employee's unique needs and preferences are considered. This can lead to higher employee engagement, increased motivation, and ultimately better outcomes for both the employee and the organization.

V. ACKNOWLEDGMENTS

Thank you to Universitas Multimedia Nusantara for all support and facilities for this study.

REFERENCES

[1] O. Alaskari, R. Pinedo-Cuenca, & M. M. Ahmad, *Framework for implementation of Enterprise Resource Planning (ERP) systems in small and medium enterprises (SMEs): A case study*. ***Procedia Manufacturing***, ***55***, 2021, pp. 424-430.

[2] U. Weerasekara, & T. Gooneratne, *Enterprise resource planning (ERP) system implementation in a manufacturing firm: Rationales, benefits, challenges, and management accounting ramifications.* ***Accounting and Management Information Systems***, ***22***, 2023, pp. 86-110.

[3] V. Kumar, R. Shankar, & P. Vrat, *An analysis of Industry 4.0 implementation-variables by using SAP-LAP and e-IRP approach.* ***Benchmarking: An International Journal, 29***, 2022, pp. 1606-1639.

[4] R. Mishra, R. K. Singh, & T. Papadopoulos, *Linking digital orientation and data-driven innovations: an SAP–LAP linkage framework and research propositions.* ***IEEE Transactions on Engineering Management***, 2022.

[5] F. Manzoor, L. Wei, T. Bányai, M. Nurunnabi, & Q. A. Subhan, *An examination of sustainable HRM practices on job performance: An application of training as a moderator.* ***Sustainability, 11,*** 2019, 2263.

[6] J. G. Kim, T. Kim, S. I. Kim, S. Y. Jang, E. B. Lee, H. Yoo, & H. Hong, *The Workplace Playbook VR: Exploring the Design Space of Virtual Reality to Foster Understanding of and Support for Autistic People*. ***Proceedings of the ACM on Human-Computer Interaction***, **6(CSCW2)**, 2022, pp.1-24.

[7] I. E. Irabor, & U. C. Okolie, *A review of employees' job satisfaction and its effect on their retention.* ***Annals of Spiru Haret University. Economic Series, 19***, 2019, pp.93-114.

[8] F. Saidi, M. F. Abdulkarim, & A. A. Ousama, *Factors affecting the integration of the SAP-financial accounting module into an accounting curriculum: evidence from a Gulf-based university.* ***International Journal of Smart Technology and Learning, 1****, 2019*, pp.218-243.

[9] E. Coşkun, B. Gezici, M. Aydos, A. K. Tarhan, & V. Garousi, *ERP failure: A systematic mapping of the literature.* ***Data & Knowledge Engineering, 142***, 2022, 102090.

[10] I. Stankov, & G. Tsochev, *Vulnerability and protection of business management systems: threats and challenges.* ***Problems of Engineering Cybernetics and Robotics***, *72*, 2020, pp.29-40.

[11] A. Shanneb, *Incorporating SAP® ERP training into industrial college education: a usability evaluation.* ***IJ Educ. Manage. Eng, 5***, 2020, pp.1-9.

[12] S. U. K. Siddiqui, S. Islam, & K. Subramaniam, *Android application development for property rental services.* ***Proceedings of Mechanical Engineering Research Day, 2022***, pp. 147-148.

[13] T. J. Wibowo, S. Suryasari, A. Aribowo, & A. E. Widjaja, *Information System to Support Order Process and Cake Design at Web-Based Online Artisan Cake Shop.* ***Ultima InfoSys: Jurnal Ilmu Sistem Informasi, 10***, 2019, pp.48-54.

[14] S. Suryasari, J. Wiratama, & R. I. Desanti, *The Development of Web-based Sales Reporting Information Systems using Rapid Application Development Method.* ***Ultima InfoSys: Jurnal Ilmu Sistem Informasi, 13***, 2022, pp.110-116.

[15] Y. Irawan, *Decision Support System For Employee Bonus Determination With Web-Based Simple Additive Weighting (SAW) Method In PT. Mayatama Solusindo.* ***Journal of Applied Engineering and Technological Science (JAETS), 2***, 2020, pp.7-13.

[16] J. A. Soosaimuthu, *Interface with Scheduling, Estimation, Costing, and Forecasting Applications*. ***SAP Enterprise Portfolio and Project Management: A Guide to Implement, Integrate, and Deploy EPPM Solutions***, 2022, pp.183-241.