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Application of Eisenhower matrix and analytic hierarchy process for decision support system with the SAW Method

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Abstract
The continuous emergence of tasks can pile up other tasks regardless of whether the task's priority is essential or urgent. This makes tasks that should be of high priority overlooked and left undone. This research was conducted to solve this problem so that there is no overlapping work for the programmer. In the research, a Decision Support System will be applied using the Analytic Hierarchy Process method and Simple Additive Weighting simultaneously, which is combined with the Eisenhower Matrix in its implementation. The application of "ngebit" will be the basis for seeing the work progress of several workers in the organization. The result obtained is a decision that can be seen from the application used in the implementation. This can provide a solution to hoarding tasks and valuable for the division of tasks based on the abilities of team members.

Keywords: DSS, Software Development, AHP, Eisenhower Matrix

1. Introduction
Purchasing activities in an industry are essential activities that have a direct effect on the continuity of the production process because they include the fulfillment of raw materials, which are the primary needs in the production process; purchasing activities for the fulfillment of raw materials cannot be separated from the role of suppliers who are the source of suppliers of raw materials (Dachs, Kinkel, & Jäger, 2019; Seo & Park, 2018) [3, 12]
In general, the existence of suppliers and the ability to supply raw materials in the correct quantity and at the right time and competitive prices are crucial things to consider (Helbig, Wietschel, Thorenz, & Tuma, 2016) [6].
With the auction sales method, products can be sold quickly and can get the highest selling price. With a competitive advantage, companies can bring different experiences in buying and selling products. Originally used goods, high-branded items, collection items that are stepping in, they are treasures, but in general, no one has focused on the auction market yet. In auction market validation, online auctions are mostly found on social media, especially on Instagram and Facebook. It has millions of transactions, but it is not practical because the auction is done in the comment column. Many the buyer who gave the highest price, but was covered by new comments that came continuously. For auctioneers, usually, a pretty expensive auction fee is given, which is 7% to 30%; this happens because the auction account provider already has many popularity and followers (Posner & Weyl, 2018; Sugiyarto, 2020) [11].
From this market validation, the “Ngebid” application was created. Ngebid is the first Customer to Customer auction application in Indonesia based on Android. This application has the main features of creating an auction, displaying products left in the last 5 minutes of the auction, following products or auctioneers, reviews, and vouchers.
For now, the Ngebid application is already in the open-beta stage. Currently, it is available on the Playstore, and more than 60 users have downloaded the application. In the development of this application, it was previously managed by an outsourced programmer team, and it's just that the work that is managed by outsourcing results in fragility in the application architecture being designed. This has an impact on the many bugs that have appeared in the Ngebid application.

When the conditions have been released, the situation will be very different, the company still has to maintain application user satisfaction and improve systems that are already running simultaneously (Epstein, Buhovac, & Yuthas, 2015). Customer satisfaction is a very serious matter, a bad experience on the user will be a serious impact to company reputation. Within the company, we develop applications using git hosting services. Besides being able to control versions, git can also control the work of employees. Every problem found will be recorded as a Bug Issue. Bug Issue Resolution is demanded for done quickly and efficiently so as not to have a bad experience for users of the "Ngebid" application. Often the Bug Issue comes at the same time, with the Bug Issue coming together, it takes an effort to address this. Each Bug Issue has a different priority level. It's just that in a very large number of Bug Issues it can make task completion unfocused and forget things that should be prioritized first. The wrong attitude will result in neglecting the Bug Issue which should be a priority to be resolved.

The problem in this research is a) often the Bug Issue comes together, with the Bug Issue coming together, it takes an effort to address it. b) Resolving Bug Issues is required to be done quickly and efficiently not to have a bad experience for users of the Ngebid application. c) In many situations where Bug Issues arise, it can make task completion unfocused and forget things that should have been prioritized first

When that happens, it will result in the emergence of a new Bug Issue that has not been completed. That is why it is necessary to Apply Eisenhower Matrix and Analytic Hierarchy Process for Decision Support System with Simple Additive Weighting Method.

2. Literature Review

The Eisenhower Matrix or Eisenhower Decision Matrix is named after the 34th President of the United States who served from 1953 to 1961, Dwight David Eisenhower. During World War II, he was a five-star general in the United States Army and served as Commander-in-Chief, preparing the strategy for the Allied invasion of Europe (Jyothi & Parkavi, 2016; Mfondoum, Tchindjang, Mfondoum, & Makouet, 2019) [9].

The Eisenhower Matrix method comes from a quote attributed to Dwight David Eisenhower:

"Have two kinds of problems, the urgent and the important. The urgent are not important, and the important are never urgent."

Making decisions using the Eisenhower method, each task is evaluated using critical, unimportant, urgent, and non-urgent criteria and then placed in a quadrant that is in the Eisenhower Matrix.

Classify and plan tasks in relative order by Urgent and Importance of tasks. These tasks are categorized into four priorities as follows:

1. "Important" and "Urgent" Tasks: they receive the highest level of priority and must be resolved as soon as possible. They are crises that must be resolved immediately.
2. "Important", but "Not Urgent" Tasks: This is a long-term task because it is important but does not have a definite deadline. They must be scheduled on time and done later.
3. "Not Important", but "Urgent" tasks: these tasks can be transferred or delegated to other professionals because they are trivial than the two precedents.
4. "Not Important" and "Not Urgent" Tasks: they are the most annoying tasks and should be eliminated or discarded, as they can become a waste of time.

The matrix representing this method is a 2 x 2 squared box named Eisenhower Box. Its representation varies from activity to activity with the same background idea: good time management and prioritization. That is why it is also known as the Time Management Matrix (Bast, 2016) [2].

Eisenhower Matrix is very informative when using a graph in the form of a chart, and in a chart, it usually has two axes, the y axis as a vertical line and the x-axis as a horizontal line. There is a term called Orthogonal on a chart, which can be interpreted as two independent things. For example, there are two variables, namely price, and performance (Gajewska & Piskrzyńska, 2017) [5].

If you make a chart, the higher the performance, the higher the price. In the exemplified chart, the chart can be categorized as a chart that is not orthogonal. Unlike the case with the orthogonal Eisenhower Matrix chart, the importance value is not tied to the urgent value, and the urgent value is not tied to the importance value (Kirillov, Tanatova, Vinichenko, & Makushkin, 2015) [8].

3. Research Methods

In application development, various divisions are involved in operational procedures. The Founder, together with the Co-Founder, researches market needs. The CTO determines what technology to use. After determining the technology used, the Project Manager performs analysis and design, then will be forwarded to the designer for sketching and wireframing.

Kanban Board

Kanban is one of the Agile methods in SDLC. The interesting difference from the Kanban compared to the scrum is that the Kanban board and its rules are much simpler when compared to the scrum board and its rules (Alaidaros, Omar, & Romli, 2018; Stellman & Greene, 2014) [1, 13].

The project manager collects the documents needed, then arranges the tasks on the Kanban board in the Trello application, which is called a card to be submitted to each head of the programmer, then assigns and monitors the task to each programmer team via the Kanban board. Kanban board is designed into four stages (Ostergaard, 2016) [10]:

To-do

The programmer can see the tasks he has to do through this stage. The Head Programmer gives a sign to whom the task is to be done on each card. In addition to giving a signal, the head programmer can also provide a target completion time for the task. The programmer can choose which card he works on first.

On progress

Every card that the programmer is working on must be transferred to this stage.

Review

When the programmer completes one of the cards he chooses, the programmer must move the card to this stage for review by the head programmer. If the head programmer finds an incomplete assignment, the card will be returned to the To-do stage.

Done

When the card has passed the check by the Head

Programmer, the card is declared complete and transferred to this stage.

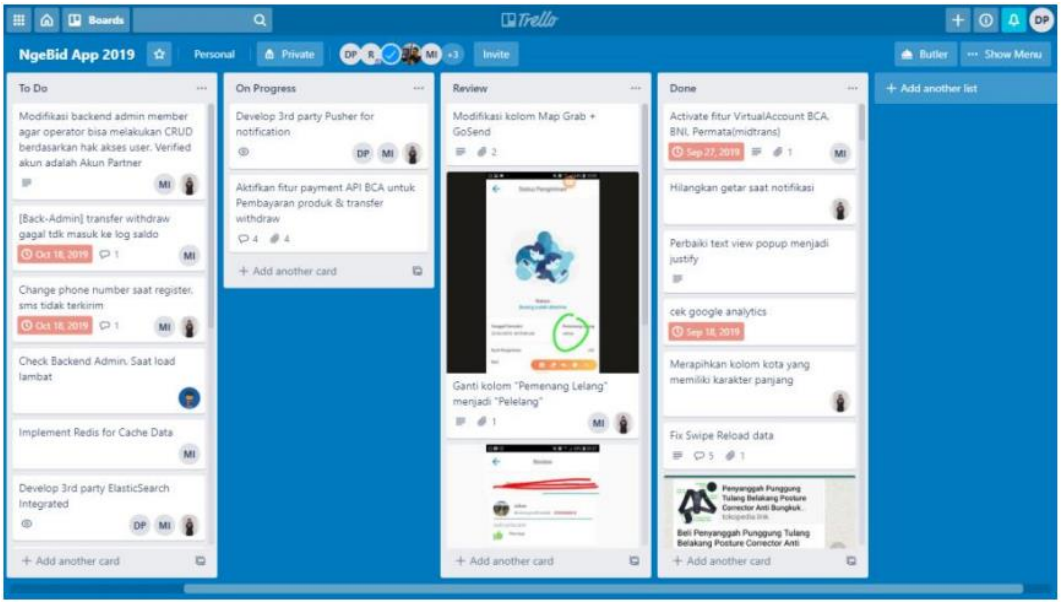

Fig 1: Kanban Board on Trello

GitHub Host

In application development implementation, code is stored on a git host called the repository. The programmer team works together to build applications using the GitHub repository that the head programmer has created. The following is the standard operational flow in developing company applications:

Grants private repository permission

Some of the git repositories are publish-grade. If it is open and can be seen by others without special permission, it is called a public repository. Public repositories are suitable for open source programs. If programs require high privacy, such as business and business purposes, then the repository is better closed; this is called a Private Repository. The head programmer gives access permission to the company's Private Repository to the programmer team he leads. The permission is sent in the form of a link via email to each programmer.

GitHub Repository Fork

In the company repository, of course, applications for production and applications for development must be separated. In the repository, the main branch is named master. If the programmer wants to perform tasks and add features to the application, the programmer must make a copy taken from the original application source; this is known as a fork.

Perform tasks in the forked repository

At this stage, programmers can do their work on their respective PCs.

Rebase, if other team members complete other tasks and have Merged

When one member of the programmer has completed his task, it will have an impact on the existence of new code in the application in the master branch. So that other programmers can keep up with the changes in the merged application. If other programmers are working on the same fork, that programmer can pull the changes on the GitHub host into local git, this is known as Push.

Commit the finished task, and pull it out

In the code change, the programmer describes the code change and verifies that the code has been changed. Commit sets can be saved in the GitHub host, which is known as Pull.

Checking the assignment of the programmer performing the Merge Request

The programmer creates a branch (branch) in the task he is working on. When the programmer pulls the work he has finished, the programmer requests the Chief Programmer to combine the code that has been worked on into the source code, this is known as a Pull Request or Merge Request.

In drawing the Eisenhower Matrix chart, the higher the urgent value, the greater the priority to work on, the closer it is to the center point of the x-axis. Eisenhower Matrix is very useful in labeling tasks, so it can help sort work by priority. Making task labels is divided into four parts, namely as following:

1. Do First

Labels for essential and urgent tasks. This task needs to be completed as soon as possible. In this task, a programmer with the best criterion score is needed to be completed quickly and reliably.

2. Decide

Labels for essential and non-urgent tasks. This task needs to be scheduled for completion.

3. Delegate

Labels for unimportant but urgent assignments. This task is more effective if it is assigned to programmers with low criteria scores so that programmers with good criteria scores can do other more important tasks.

4. Dump

Labels for non-urgent and non-urgent assignments. This task is recommended to be deleted.

Here is a diagram of the Eisenhower Matrix:

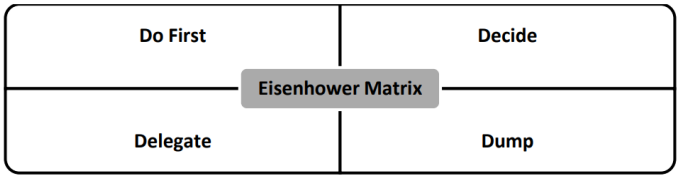

Fig 2: Eisenhower Matrix Diagram

For the Eisenhower Matrix to be applied to programmer tasks, it requires a Criteria assessment for each programmer. This function is to classify Programmers based on their performance (Gajewska & Piskrzyńska, 2017).

The following is a table designed programmer criteria:

Table 1: Design Programmer Criteria

Criteria	Description	Type	Scoring
Expertise	Mastery in Program	Benefit	0 to 100
Speed	Average task completion with difficulty level intermediate based on minutes	Benefit	0 to 100
Code efficiency	Efficiency of writing in lines of code	Benefit	0 to 100
Discipline	Discipline level	Benefit	0 to 100
Team Work	Assessment programmers can work together in teams	Benefit	0 to 100

4. Results and Discussion

Implementation has needs that are needed so that the application can run properly. Implementation needs are divided into two, namely hardware requirements and software requirements.

The application below is the result of the front display design in the "Ngebit" application, where the process of determining the criteria is based on the information that has been previously obtained.

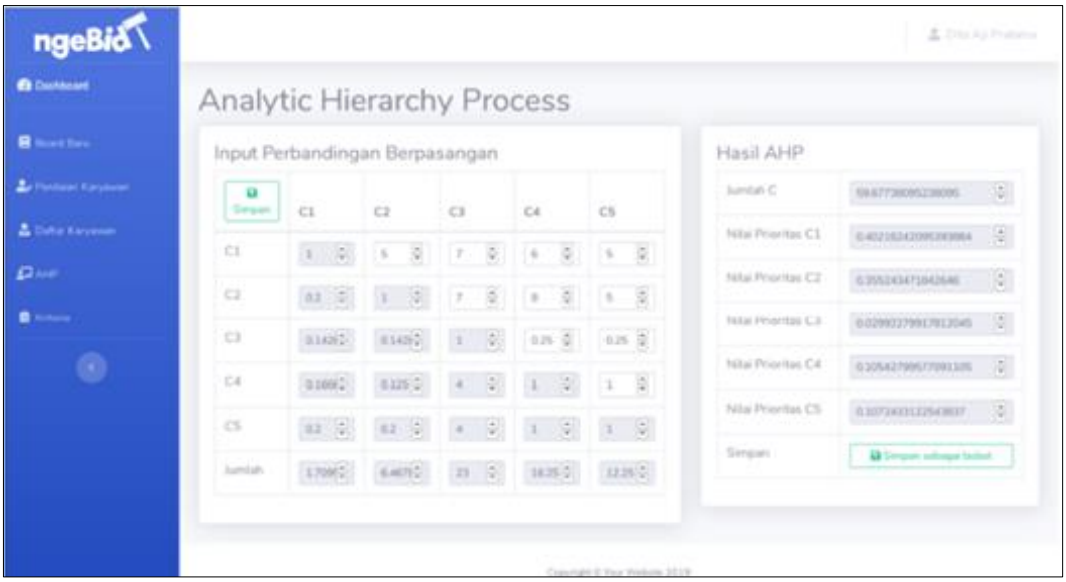

Fig 3: Analytic Hierarchy Process Display

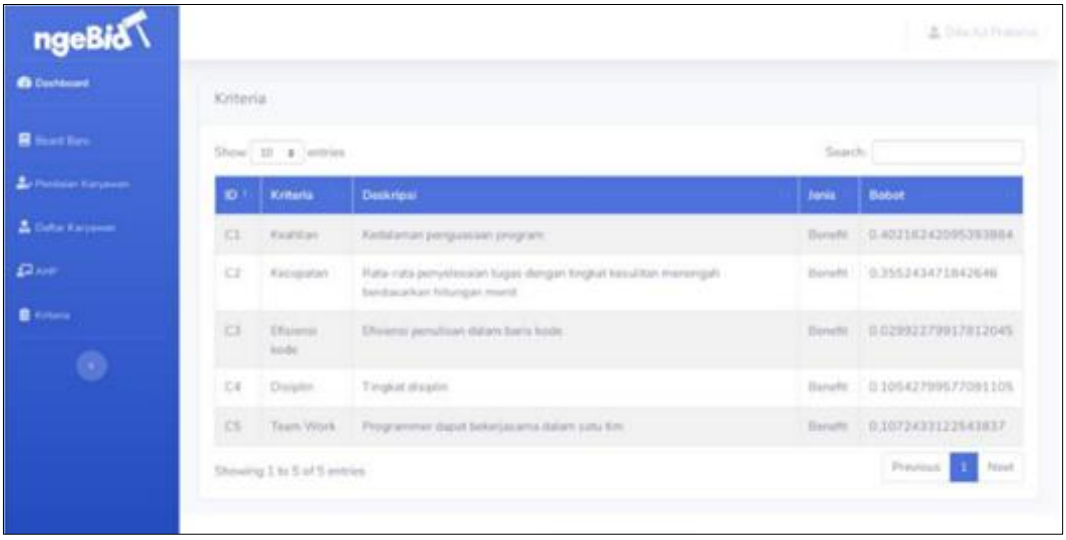

Fig 4: Criteria of AHP

The criteria chosen must cover all essential aspects related to the objectives to be achieved.

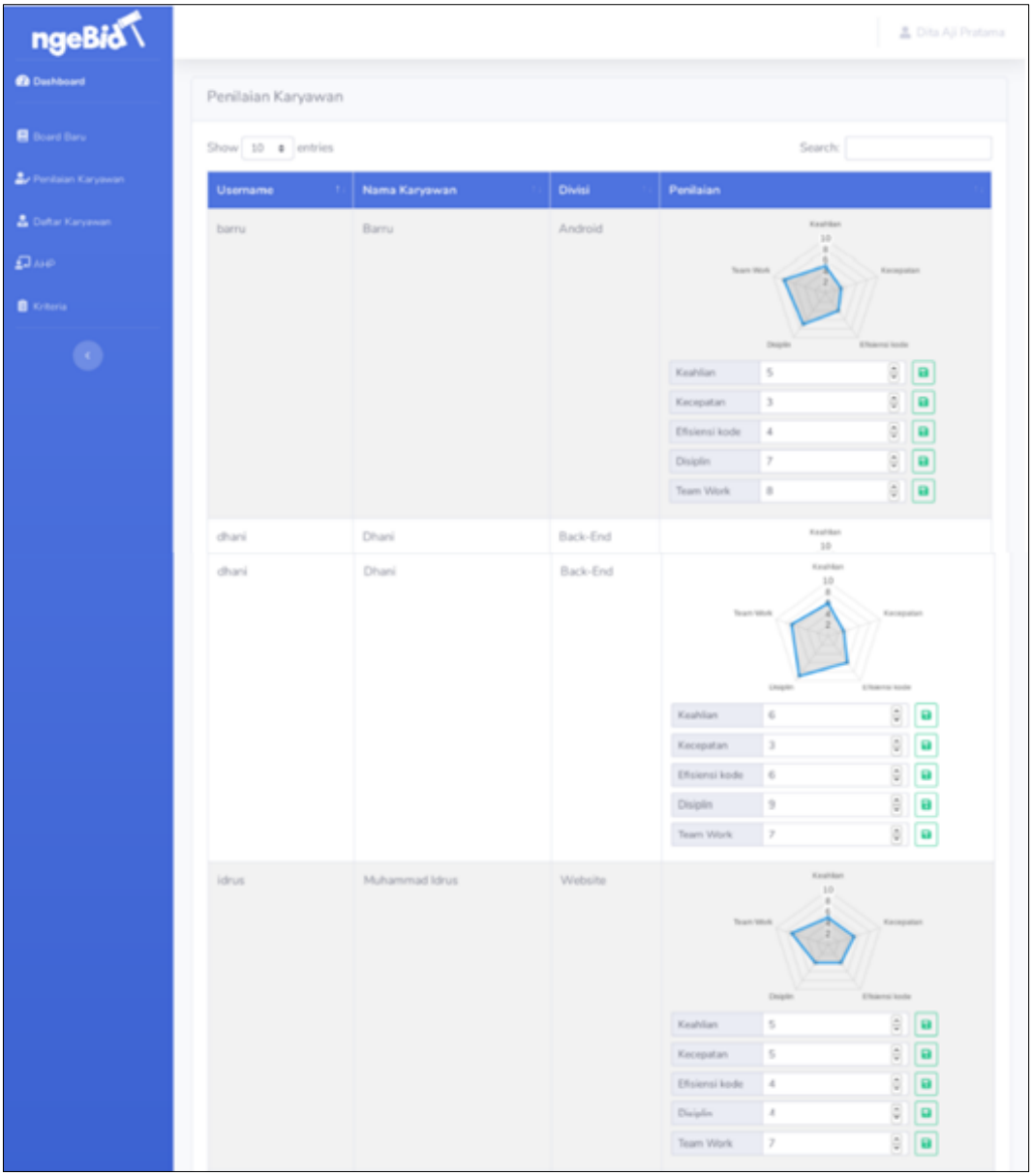

Fig 5: Employee assessment

Arranging a hierarchy is a step in which a predetermined goal is then described systematically into a structure that compiles a series of systems to achieve goals rationally. In other words, an intact goal is decomposed into its constituent elements.

However, we must still consider that the criteria chosen have meaning for decision making and do not have the same meaning or meaning so that even though the selection criteria are few, they have significant meaning for the goals to be achieved

Request-Response Testing can be done using the JMeter application. Testing with JMeter is beneficial for knowing application and server limitations to accommodate a user activity. For the use of this application alone in a day is approximately 50 activities. In testing, will be tested with 500 sample activities on each page.

Table 2: Request-Response Results

Label	Samples	Error %	KB/Sec
Dashboard	500	0.00%	25.45
Employee Assessment	500	0.8%	96.83
List of Employee	500	4.4%	33.82
AHP	500	8.8%	32.33
Criteria	500	2.4%	24.3
Board	500	11.4%	52.77
TOTAL	3000	4.63%	256.61

From the test results, it can be concluded that the average probability of error when doing 500 sample activities on the whole page is 4.63%. The most error-prone page is the board page with a value of 11.4%, and the page without errors is the dashboard page with a value of 0%.

Behavior Driven Development is a test that focuses on the way a business functions or not. This is also more commonly known as Blackbox testing.

The following is the Behavior Driven Development test table:

Table 3: behavior driven development testing

Testing	Page	Results	Status
Enter the wrong login username	Login	Exit popup with failed username login message	Pass
Input the correct login username	Login	Redirect to the dashboard page	Pass
Logout	Index	The session is finished and returns to the login page	Pass
Displays the criteria table	Criteria	Exit data ID, Criteria, Description, Type, and Weight	Pass
Pairwise comparison input form	AHP	The form is calculated automatically and the calculation results are accurate	Pass
AHP results	AHP	Automatically calculates the priority value and the calculation is accurate	Pass
Save the pairwise comparison input	AHP	Save the AHP count with the save button	Pass
Save the criteria weights	AHP	Save the resulting weight values with the save button	Pass
Displays the employee table	Employee	The censored username, password, name, title, and division data exit	Pass
Adding employees	Employee	Data added successfully	Pass
Edit employees	Employee	The employee edit popup form exits, and the data is successfully edited when submitted	Pass
Remove employees	Employee	Data deleted successfully	Pass
Displays the employee assessment table	Employee assessment	Exit data Username, employee name, division, and assessment	Pass
Displays the assessment data in the form of a radar chart	Employee assessment	Radar chart displays accurately	Pass
Scoring form	Employee assessment	Ratings can be changed and saved	Pass
Create a new board	Index	A popup form appears to add a new board, redirect to the board page after adding the board is successful	Pass
Display board options	Dashboard	The list of boards that have been created will appear	Pass
Display board	Board	Shows 4 stages of the board without problems	Pass
Line Chart of Eisenhower matrix results	Board	Line Chart displays accurate data	Pass
Add card form	Board	Card added successfully	Pass
Table edit the order of important or urgent categories board	Board	The button functions properly and automatically updates the Line Chart display	Pass

5. Conclusion

From the results of the analysis carried out, several conclusions are drawn; namely, teamwork becomes more effective and efficient because the tasks have been grouped based on the ability of each programmer, management can know the strengths and weaknesses of each employee better than before, tasks are more neatly organized with segregation of duties based on importance and urgent value.

This method can be applied not only to application development but also to be developed in other cases. Decision-making based on the SAW method alone can only process data to find out who is the best, but with the addition of the Eisenhower Matrix method, which has low abilities, even so, it can be empowered.

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