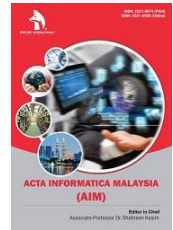


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RESEARCH ARTICLE

FAST DEVELOPMENT KANGEAN ISLAND TOURISM WEBSITE USING MAF-INC MODELAndy Rachman^a, Muchamad Kurniawan^a, Choirul Anam^a, Ricky Eka Putra^b, Nanang Fakhrrur Rozi^a, Sulistyowati^c, Adib Pakarbudi^c^aInformatics Engineering, Institut Teknologi Adhi Tama Surabaya, Indonesia^bDesain Produk, Institut Teknologi Adhi Tama Surabaya, Indonesia^cInformatics Engineering, Universitas Negeri Surabaya, Indonesia^{*}Corresponding Author Email : andyrach1910@itats.ac.id

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ABSTRACT

Application development is generally carried out for 90 days or 12 weeks, and there are even some projects up to 180 days. The longer the development time for a software project, the more wastage of time, money, and effort from the developer's side. Researchers offer a new method solution, MAF-INC, to speed up application development time. MAF-INC is an application development method combining Two Models: the Merapi Analysis Framework (MAF) and the Incremental Model. From the results of the implementation of the MAF-INC Model, researchers can develop web applications for Kangean Island tourism for 74 days, and this is better than the incremental Model in general. In this research, we focus on web software developed. The novelty of this manuscript is we use Merapi Analysis Framework (MAF) for ideas validation and combine it with the Incremental model. The test results show that the development of applications can be completed faster, between 5% -18%.

KEYWORDS

Software engineering, Merapi Analysis Framework, Software Process Model, Incremental Model, Kangean Island

1. INTRODUCTION

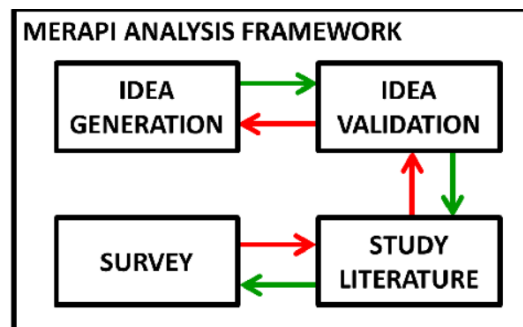
Madura is one of the islands in East Java. Madura Island has four districts: Bangkalan, Sampang, Pamekasan, and Sumenep (Diana et al., 2018). Kangean is one of the islands in Madura, East Java, Indonesia which is included in Sumenep Regency (Lunt, 2019). Kangean Island is located at coordinates 5°4'39" North Latitude and 114°36'5" East Longitude. On Kangean Island, there are two large sub-districts, Arjasa and Kangayan sub-districts [3] and one more sub-district of Sapeken (Mansyur, 2021). Kangean Island has an area of 648.56 km²; based on available data, Arjasa District is the largest District, filling 11.56% of the total size of Sumenep Regency, Madura. The people of Kangean Island still hold the tradition of cooperation and cooperation (Aisiyah, 2020). The location of Kangean Island from Surabaya must be reached by ship for 4-10 hours via Kalianget Port, Sumenep Regency, East Java.

The beauty of Kangean Island is still not widely known by people outside Kangean Island. Until now, the local community has only enjoyed its beauty as an example of the beauty of Mamburit Beach, Green Grassland, White Sand Tourism, and the Beauty of Patapan Beach. This condition causes researchers to develop Kangean Island tourism applications. Researchers collaborated with the Head of Kalinganyar Village in developing Kangean Island tourism applications. Researchers develop an application using the Merapi Analysis Framework (MAF) and the Incremental Model. The Merapi Analysis Framework (MAF) is a framework used to ensure valid or invalid research ideas (Rachman and Rochimah, 2021). At the same time, the incremental Model is a model used for application development for Kangean Island tourism (Yang et al., 2021).

2. LITERATURE REVIEW

2.1 Merapi Analysis Framework (MAF)

Merapi Analysis Framework (MAF) is used to validate research ideas. MAF has four main stages: Idea Generation, Idea Validation, Literature Study, and Survey (Rachman and Rochinah, 2021). The process in MAF can be seen in figure 1.

**Figure 1:** Merapi Analysis Framework (MAF) Process.

Idea Generation is the stage of generating ideas or the process. This process can be done anytime, anywhere in connection with the emergence of ideas. From this idea generation action, the researcher records the ideas that arise in his mind, with the main key being "What problems are solving". The second action is Idea Validation. In this section, the

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researcher carries out the idea validation process by ascertaining the target user of the application by answering "Who is the user application" or "Who is the target user". The third action is Study Literature, an action related to application development literature starting from the Model used, algorithms, techniques, programming languages, and other tools. The fourth action is a survey; a survey is conducted to determine the environmental conditions of application users: customers and end-users.

2.2 Software Engineering

Software Engineering is a discipline that emerged in the 1980s. According to the SWEBOK Guidelines, Software Engineering is defined as the application of a systematic, disciplined, measurable approach to software development, operation and maintenance, namely the application of engineering to software (Khalid et al., 2020). Software development currently exceeds unimaginable limits. In 2021 the global market for world software engineering will reach \$565 billion, the largest segment in enterprise software with projected revenues of \$237 billion in 2022 (Kinsta, 2023). The existence of software has affected human life in the world. Software development is a complex process and requires professional resources (Nana et al., 2022).

The main goal of Software Engineering is to create reliable and quality software for target users (Alam et al., 2022). In software development, software developers use the software development model (Wlodarski et al., 2022). Software engineering work practices are the key to success in the digitalization era (Schneider and Betz, 2022). There are two types of software development models, namely the traditional model and the fast model: waterfall, spiral, rapid application development, incremental, v model, agile, extreme programming, Kanban, Scrum, DSDM, and

others (Lalmi et al., 2021; Pinto et al., 2020). Software requirements engineering is a major issue concerning the resulting software product in the software development process. Errors in the requirements engineering process impact: a lack of description of software requirements and a very large workload of compiling and maintaining software requirements (Kai, 2022). Wencheng Guo et al. developed transient process simulation software for hydropower stations in their research. With the application developed, the user can find out the graph of the ups and downs of the hydroelectric power plant; the calculation process is carried out quickly and accurately (Guo et al., 2021). The general application development process takes 90 days or 12 weeks.

2.3 Incremental Model

The incremental Model is a software development model that developers widely use. The Incremental Model is a development of the iterative waterfall Model. This Model combines all incremental results to produce the final software (Almazaydeh et al., 2022). Using an incremental model, developed a game-based learning application to introduce fruit and vitamins (Rachman et al., 2019). The application developed by the researcher obtained an assessment result of 82% based on the ISO 9126 usability factor, which means that the application is very useful for the end user of the application (Rachman et al., 2019). As a state that the incremental Model has five main activity stages: requirements, design, coding, testing, and implementation (Andreansyah et al., 2020). Each increment cycle is always repeated to get maximum results (Andreansyah et al., 2020). According to Jiujiu Yu, the incremental Model is a monolithic model that combines the sequential features of the waterfall model with fast iterative features. Each increment is done based on the previous increment (Yu, 2018).

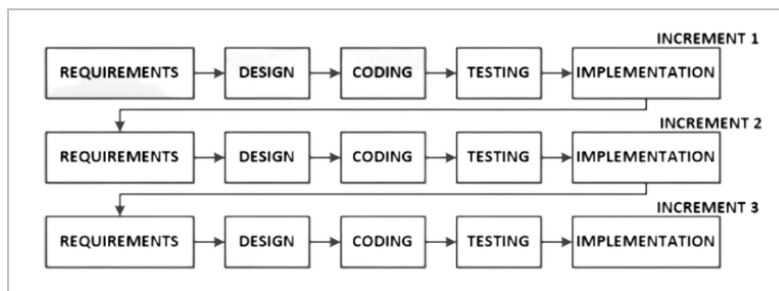


Figure 2: Software Process Model Incremental (Andreansyah et al., 2020).

2.4 ISO 9126-3

ISO 9126 is one of the international standards launched by the International Organization for Standardization (ISO). This organization (ISO) was founded in 1946, while the ISO 9126 model was launched in 1991 (Syamranata et al., 2019). ISO 9126 provides a common perspective among developers in measuring quality requirements, ease in comparing one software product to another, and consistent terminology. ISO 9126

supports strategic decision-making for software products to determine quality (Fitriani et al., 2019). ISO 9126 defines a set of features and characteristics of products and services that can be executed during testing at later development stages (Wang et al., 2019). Model ISO 9126 is part of ISO 9000 which focuses on quality assurance. There are six characteristics in ISO 9126, namely functionality, reliability, usability, efficiency, maintainability, and portability (Hendriyani and Amrizal, 2019).

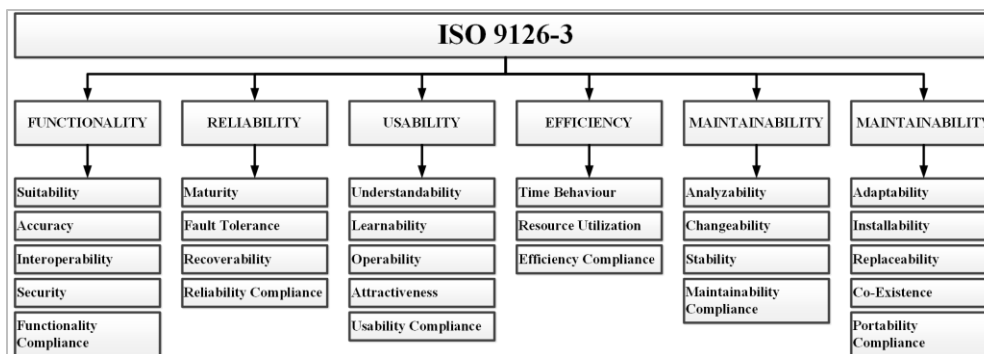


Figure 3: Characteristics and Sub-Characteristics at ISO 9126-3.

3. RESEARCH METHOD

In the study, researchers developed a Kangean Island tourism web application using two models, namely the Merapi Analysis Framework (MAF) and the Incremental Model. The research methodology carried out can be seen in Figure 4.

In Figure 4, it can be seen that researchers carry out three main activities, namely Idea Validation to ensure that the research being carried out is feasible or not, the second step is for researchers to develop applications

by utilizing the incremental process model software, and the third step is Analysis where the analysis process is carried out by researchers using ISO 9126-3.

3.1 Idea Validation Using MAF

Idea Validation confirms whether a research idea can be carried out. Here researchers utilize the Merapi Analysis Framework (MAF). MAF consists of four main activities, namely Idea Generation, Idea Validation, Literature Study, and Survey, as shown in figure 5.

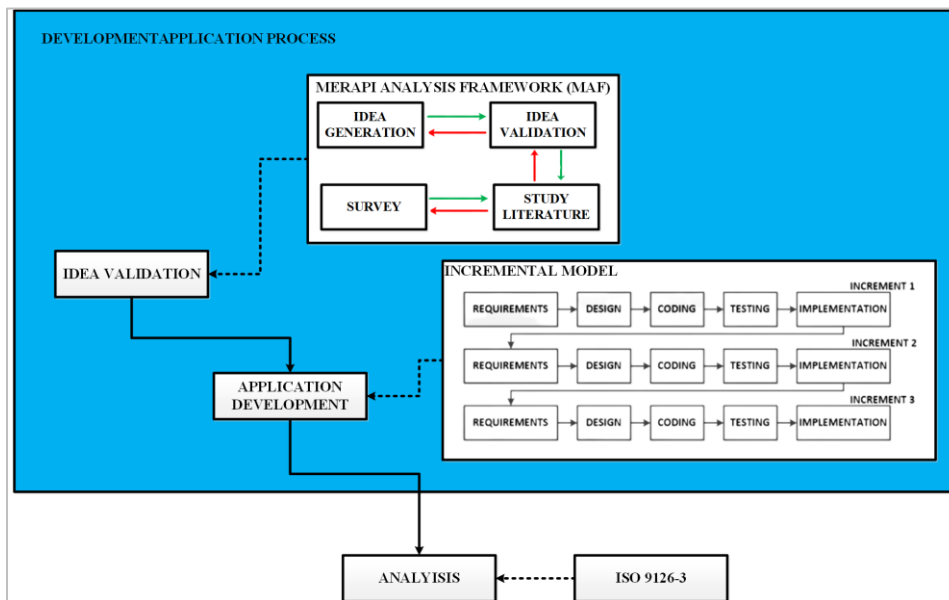


Figure 4: Research Methodology for Development Kangean Island Tourism Website.

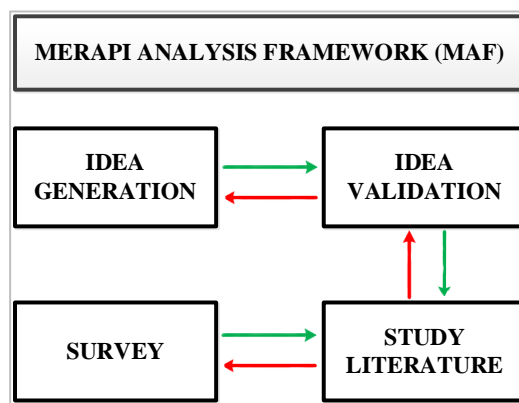


Figure 5: Merapi Analysis Framework (MAF).

Researchers use Idea Generation to initiate the emergence of research ideas. In Idea Generation, some things must be answered so that research can proceed to the next stage. The questions are "what problems are solving" or "what applications are being developed". The second process in MAF is Idea Validation. In this activity, researchers focus on "target application users or who are application users". In the third step, the researcher focuses on libraries that can assist in application development, starting from programming languages, additional software, and previous studies. The fourth step in MAF is Survey. The survey researchers conducted concerning the application development process.

Idea Generation

In the Idea Generation section, which begins with the question "What problems are solving", the researcher gets information from Informatics Engineering students - ITATS who come from the Kangean Island area where the student tells the conditions on Kangean Island have very good

and beautiful tours but still lack the process development and promotion. From this information, the researcher finally came up with an idea: "How about developing a Kangean Island tourism web to promote regional tourism".

Idea Validation

The idea is validated by browsing information and various tours on Kangean Island. The researcher determines that the target audience for developing this application is the people of Kangean Island and outside Kangean Island.

Study Literature

The process of studying the literature was carried out by researchers in connection with the development of the Kangean Island tourism web application, including:

Table 1: Study Literature Pada Pengembangan Aplikasi Website Pariwisata Pulau Kangean.

NO	Literature	Fungsi
1	MERAPI ANALYSIS FRAMEWORK : IDEAS VALIDATION OF APPLICATION DEVELOPMENT IN THE INDUSTRIAL AGE 5.0, Research Methodology (Concepts and Cases), Novateur Publication, 2021.	Research Idea Validation
2	Implementation of Incremental Models on Development of Web-Based Loan Cooperative Applications, International Journal of Education, Science, Technology, and Engineering, 2020.	Software process model for developing Kangean Island tourism web applications
3	Practical PHP 7, MySQL 8, and MariaDB Website Databases: A Simplified Approach to Developing, Apress, 2018	Kangean Island tourism web application development
4	Pro CodeIgniter: Learn how to create professional web-applications with PHP, Digital Agency, 2021	Kangean Island tourism web application development
5	Web information about Kangean Island tourism	Get information about Kangean Island and its tours.

Survey

After the third stage, the researchers surveyed Kangean Island, to be precise, in Kalinganyar Village, Sumenep Regency, Madura, East Java. Researchers also surveyed by visiting tourist attractions related to

research, starting from the Jamik Mosque, Rajasa Square, Celgung Tourism, Mamburit Beach, Kalisangka Tourism, and other tourist destinations. Researchers also conducted an online survey of 100 people about the existence of Kangean Island. Researchers conducted four online survey questions, as shown in Table 2.

Table 2: Survey About the Existence of Kangean Island

NO.	QUESTION	AGREE	DISAGREE
1	Do you know Madura Island?	83	17
2	Did you know that Madura has 4 districts?	37	63
3	Do you know about Kangean Island?	11	89
4	Did you know that Kangean Island is included in Madura Island?	11	89

Based on table 2, it was found that 83% of respondents knew about the existence of Madura Island, while 17% of respondents did not know about Madura Island. In the second question about the number of districts in Madura, 37% of respondents knew that Madura had four districts, while 63% did not. For the third survey question about the existence of Kangean

Island, 11% of respondents knew Kangean Island, and 89% did not know Kangean Island. In the fourth survey question about Kangean Island being included in Madura Island, 11% of respondents knew that Kangean Island was included in Madura Island. In comparison, 89% of respondents did not know it. Online survey results can be represented in chart form.

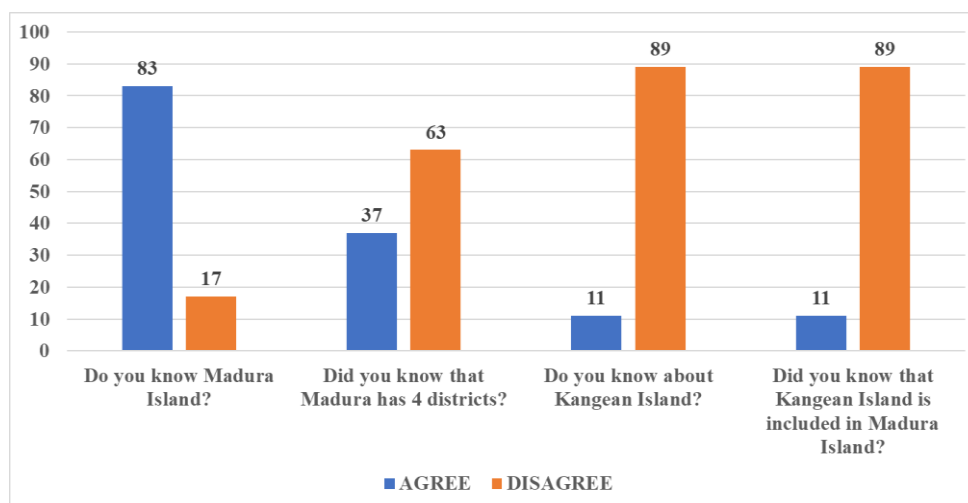


Figure 6: Survey of the Existence of Kangean Island.

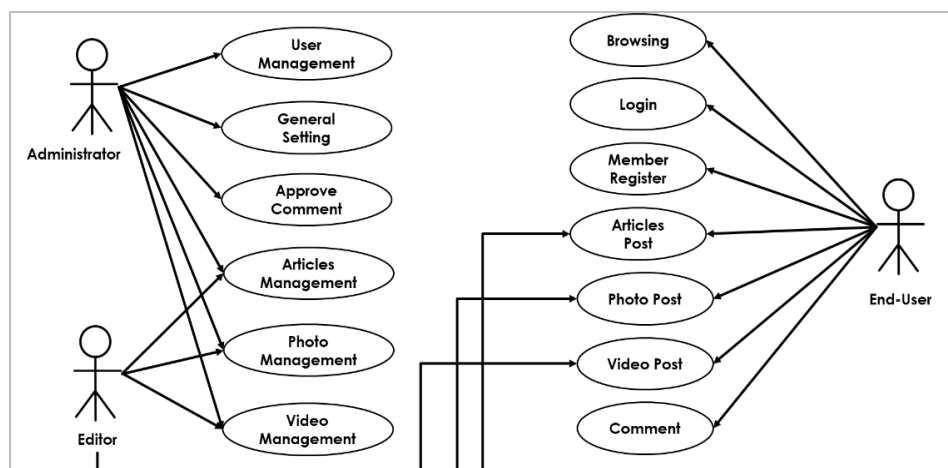


Figure 7: Use Case Diagram Kangean Island Tourism.

From Figure 6, it can be seen that there are still many respondents who do not know about the existence of Kangean Island on Madura Island, East Java.

3.1.1 Application Development

Application development carried out by researchers utilizes the incremental model. The incremental model has five activities: requirements, design, coding, testing, and implementation. These five activities are carried out repeatedly. The application development process was carried out by researchers in two increments. The researcher's first Increment process focuses on features for Administrator and Editor actors while the second Increment researcher focuses on end-user actors.

For Administrators, there are six main features: user management, general

settings, approve comments, articles management, photo management, and video management. For Editors, six features can be accessed: articles management, photo management, video management, articles post, photo post, and video post. For end-users, there are seven main features: browsing, login, member register, articles post, photo post: video posts, and comments.

3.2 Requirements

The researcher carries out the requirements process only once, even though in the incremental model, each increment contains five activities because the requirements process must be carried out once and becomes the benchmark for application development. Some actions taken in the requirements process have been carried out in the Idea Validation section, namely, Study Literature and Survey. At this stage, the researcher

interviewed the people on Kangean Island. The community is the village head, school head, teachers, the general public, high school students, and

university students. The total number of respondents for interviewing the development of the Kangean Island tourism web application was 50.

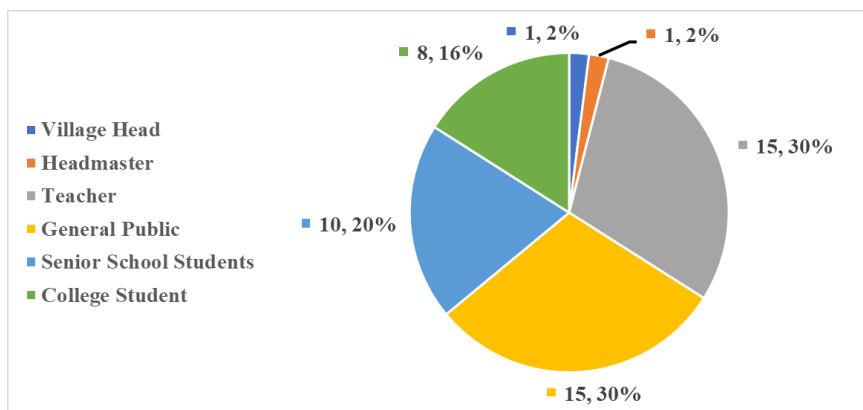


Figure 8: Respondent Interview for Kangean Island Community.

Table 3: Interview About Kangean Island Tourism Web Development.

NO.	QUESTION	AGREE	DISAGREE
1	Does Kangean Island need a web that the public at large can access?	50	0
2	Does Kangean Island need a Kangean tourism website?	50	0
3	If there is a Kangean Island tourism website, do you want to access and use the Kangean Island tourism website?	50	0
4	Are you willing to become a tourism ambassador for Kangean Island?	44	6

From Figure 8, information was obtained that there were 6 types of respondents used for interviews for the development of the Kangean Island tourism web application, namely 1 village head, 1 headmaster, 15 teachers, 15 general public, 10 senior high school students, and college students as many as 8 people.

From the requirements activity, functional and non-functional requirements for developing the Kangean Island tourism web application are obtained. The functional requirements for the Kangean Island tourism web application include the following:

- I. The system can provide tourism information on Kangean Island
- II. The system provides registration and login features for users.
- III. The system provides an article-posting feature.
- IV. The system can provide a photo upload feature.
- V. The system can provide a video upload feature.
- VI. The system provides a comment feature.
- VII. The system can perform user management.
- VIII. The system provides setting features.
- IX. The system can approve comments.
- X. The system provides photo management features.
- XI. The system provides video management features.

The non-functional requirements for the development of the Kangean Island tourism web application are as follows:

- I. The Kangean Island tourism web application can be accessed on computers, laptops and smartphones.
- II. The Kangean Island tourism web application can be accessed via Google Chrome, Mozilla Firefox, and Internet Explorer browsers.
- III. The Kangean Island tourism web application must be able to provide information in no more than 10 seconds.
- IV. The application has an easy-to-understand interface.
- V. The application has an easy-to-learn interface.
- VI. The Kangean Island tourism web application must be able to

protect the system from unauthorized access.

3.3 First Increment

As mentioned in the previous section, the researchers focused on application features for Administrator and Editor actors in the first increment. Administrators use the User Management feature to manage the functions of all users who use the Kangean Island tourism web application, including Editors and End-Users. The General Settings feature is used to make general settings, from editor settings to editor passwords, documents, news, and others. The Approve Comment feature is used to provide comment rights written by end-users. This feature ensures that comments that other users can read do not offend ethnicity, religion, race and inter-group (SARA). If the administrator approves the comments, other end-users can read the comments. The Administrator actor also has management rights on articles; this is the same as the editor's rights, with the aim that if an unexpected event occurs, the administrator can temporarily replace the editor's function. The administrator is also responsible for photo documents sent by end-users. The rights of this administrator are the same as the rights of the editor in photo management. The last administrator feature is video file management. Actor Editor also owns video file management features.

For actor editors, it features article management, photo management, video management, article posting, photo posting and video posting. The article management, photo management, and video management features have been described in the Administrator actor section. An Editor has access to write articles, post photos, and post videos. Post photos and videos in connection with articles published on the Kangean Island tourism website.

3.4 Second Increment

In the second increment, the researchers focused on developing Kangean Island tourism web applications for end-user features. In general, end-users can access the Kangean Island tourism web to get all information about tourism on Kangean Island. So that end-users can create articles, upload photos, or upload videos, the end-user is required to register and carry out the login process. To provide a comment, the end user does not need to log in, the end user can comment on news, photos or videos, but the end user must wait until the administrator validates the comment to appear on the page.

3.5 Testing

The testing process was carried out by researchers using black box testing. In black box testing, the researcher tested the functionality of the Kangean Island tourism web application. There is the black box testing instrument for the main web page functionality.

Table 4: The Main Menu Testing Instrument for Kangean Island Tourism Web.		
ID	TESTING INSTRUMENT	EXPECTED RESULTS
TC-01	Accessing the Kangean island tourism main page.	The system displays the main page of the Kangean Island tourism website.
TC-02	Accessing news on the Kangean island tourism website	The system displays information on accessed tourism web news.
TC-03	Accessing the menu on the Kangean Island tourism website	The system provides menu performance on accessed tourism websites.
TC-04	Accessing photos on the Kangean Island tourism website	The system displays photos of accessed tourism websites.
TC-05	Close the Kangean island tourism web window by pressing the X button.	The Kangean island tourism website closes the application.
TC-06	Leave a comment on the Kangean Island tourism website	The system saves comments given by end-users

Table 5: The Login Menu Testing Instrument for Kangean Island Tourism Web.		
ID	TESTING INSTRUMENT	EXPECTED RESULTS
TC-07	Leave the email and password with blank input	The system cannot log in to the next menu and handles the error that the email cannot be empty
TC-08	Fill in the email but leave the password blank	The system displays an error message and provides information that the password cannot be empty
TC-09	Blank email, but fill in the password	The system provides information that the email cannot be empty
TC-10	Fill in the email and password, but one of the inputs is wrong	The system handles errors by providing information that the error lies in the email or password
TC-11	Fill in the email and password correctly	The system goes to the member page.

3.6 Analysis

The last stage of this research is to analyse the success of the application being developed. Researchers conducted the analysis process by applying ISO 9126-3 for Functionality, Usability, and Portability Factors. Researchers surveyed 100 respondents who had used the Kangean Island tourism website. For the Functionality Factor, the assessment is on suitability, accuracy, interoperability, security, and Functionality Compliance sub-factors. For the Usability Factor, the assessment is carried out on the understandability, learnability, operability, attractiveness, usability compliance sub-factors. For the Portability Factor, the assessment is carried out on the adaptability, installability, replaceability, Co-Existence, and portability compliance sub-factors. After this process, the authors conducted an analysis of the application development

completion time.

4. FINDINGS AND DISCUSSION

4.1 Findings

Researchers have succeeded in developing a Kangean Island tourism website accessed at <https://pulaukangean.id/>. The application development is implemented by implementing two combined models, namely the Merapi Analysis Framework (MAF) and the Incremental model.

The application development process takes a total of 74 days. Where 10 days are used for Idea Validation and 64 days for application development.

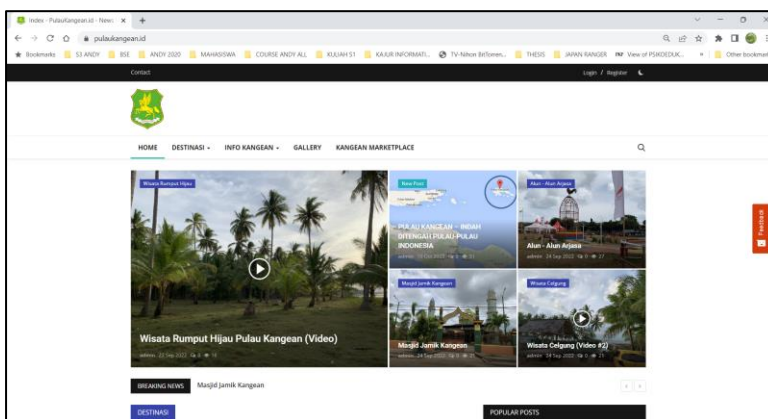


Figure 9: Kangean Island Tourism Website.

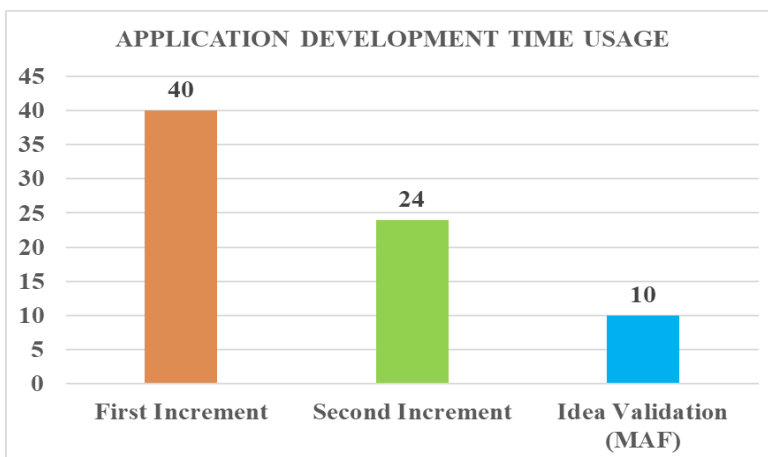


Figure 10: Kangean Island Tourism Web Application Development Time.

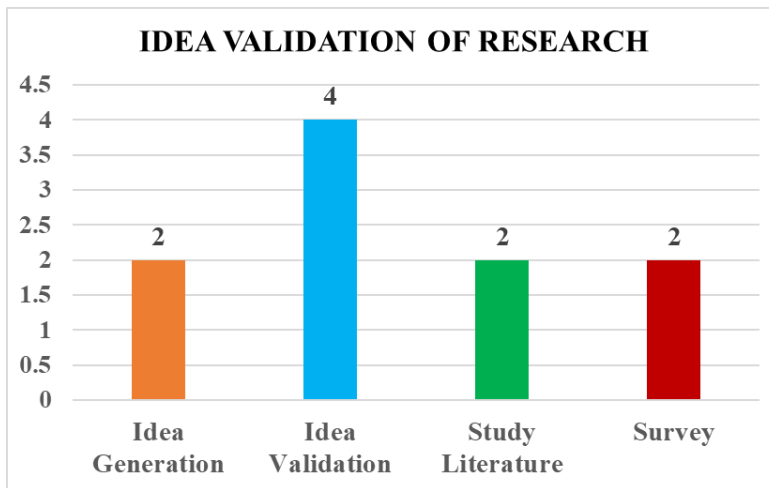


Figure 11: Time required for Idea Validation using MAF.

For Idea Validation, each step takes 2 days for idea generation, 4 days for idea validation, 2 days for literature study, and 2 days for the survey process.

4.2 Respondents

Respondents in this study are the general public who have used the tourism website <https://pulaukangean.id/>. Of the 300 visitors to <https://pulaukangean.id/>, 100 respondents were willing to complete the survey form. From the available data, it can be seen that there were 37

female respondents and 63 male respondents..

4.3 Testing

From the results of the black box test conducted by the researcher, there were a total of 51 black box tests for the Kangean Island tourism web application consisting of six register form tests, six main menu form tests, three approval comment tests, six user management tests, seven general setting tests, nine articles management, seven photo management tests, and seven video management tests.

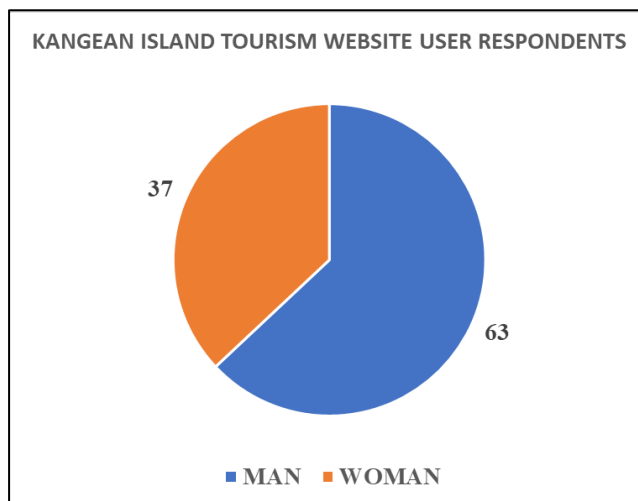


Figure 12: Kangean Island Tourism Website User Respondents.

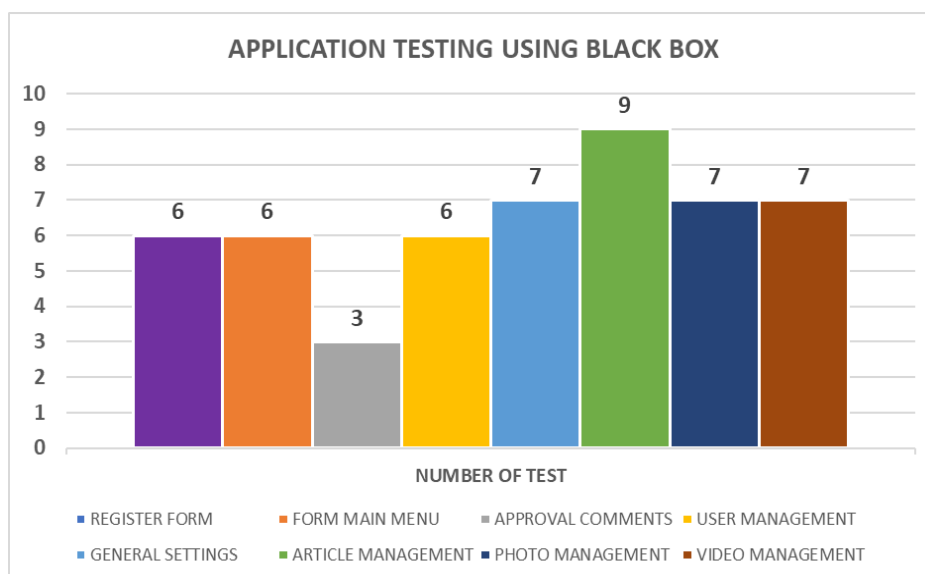


Figure 13: Kangean Island Tourism Website Black Box Testing.

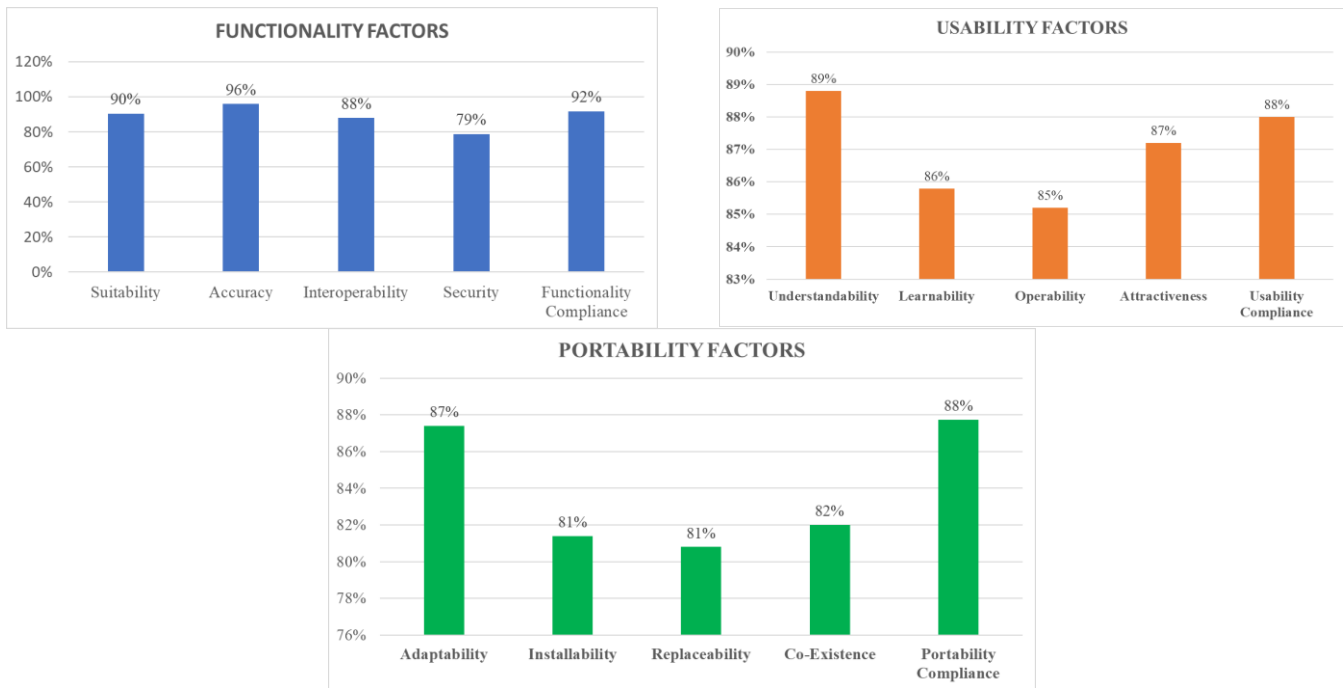


Figure 14: Respondents' Assessment Results for Kangean Island Tourism Web.

4.4 Analysis

The researcher analysed using ISO 9126-3 for Functionality, Usability, and Portability Factors. For the Functionality factor, the Kangean Island tourism web application gets an average yield of 89%. The value of 89% is obtained by the average value of the suitability sub-factor of 90%, the accuracy sub-factor is 96%, the interoperability sub-factor is 88%, the security sub-factor is 79%, and the functionality sub-factor compliance gets a value of 92%. The Usability factor gets an average value of 87%. 87% is obtained from the average value of the five usability sub-factors: the understandability sub-factor of 89%, the learnability sub-factor of 86%, the operability sub-factor of 85%, and the attractiveness sub-factor of 87%, and the usability compliance sub-factor by 88%, and the Portability factor gets an average of 84%. The value of 84% is obtained from the

average of the five portability sub-factors, namely the adaptability sub-factor obtains a value of 87%, the installability sub-factor obtains a value of 81%, the replaceability sub-factor obtains a value of 81%, the co-factor sub-factor existence of 82%, and the portability compliance sub-factor gets a value of 88%. This data is simulated as shown in Figure 13.

5. DISCUSSION

In the research that has been done, researchers combine the Merapi Analysis Framework and the Incremental Model. The time required for application development is 74 days. These results have been compared with 10 projects that used only the incremental Model. The results were that the use of MAF-INC with the Incremental Model was generally much faster by 5% -18%.

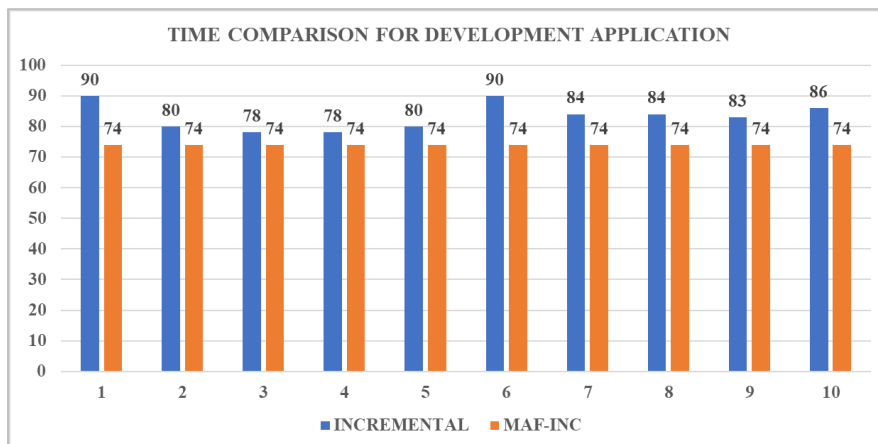


Figure 15: Comparison of Application Development Time between MAF-INC and Traditional Incremental.

The time efficiency gained comes from the utilization of MAF, which is carried out first before the application development process, so the requirements section has helped some of its activities.

application development time, as mentioned above.

6. CONCLUSION

From the research results, researchers have succeeded in developing a Kangean Island tourism web by utilizing the MAF-INC Model. With this model, the time needed is also more efficient, around 5% -18%. The application has also been assessed by 100 respondents, where the assessment process uses a survey by implementing ISO 9126-3 for Functionality, Usability and Portability factors with values of 89%, 87% and 84% which means the application functions very well, the application is very useful for respondents, and the application is very good to use on various mobile devices. The combination of the Merapi Analysis Framework and the Incremental Model in this study helps to streamline

LIMITATION AND FURTHER RESEARCH

The limitation of this study is that the MAF-INC model test process is only for web development. The success of MAF-INC depends on the place or area that is the main destination, where if there are difficulties in surveys and interviews, it affects the time to complete application development. The success of MAF-INC has not been tested with the use of other models such as Rapid Application Development, Spiral, V-Model, Prototype, and Agile.

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