Risk Analysis Using Multi-Attribute Failure Mode Analysis Approach in Mybeb Social Payment Application

Bob Maulana Adam[1], Zeplin Jiwa Husada Tarigan[2]
[1]Postgraduate Student, Master of Industrial Engineering Department, Institut Teknologi Adhi Tama Surabaya, Surabaya
[2]Lecturer, Faculty of Business and Economics, Petra Christian University, Surabaya
Email: [1]bobmaulanaadam8@gmail.com, [2]zeplin@petra.ac.id

Received: 2021-12-28; Received in revised from 2022-03-21; Accepted: 2022-03-28

Abstrak

MyBeb adalah aplikasi pembayaran sosial milik salah satu perusahaan FinTech di daerah Sidoarjo, Provinsi Jawa Timur. Mybeb sendiri merupakan aplikasi yang menyediakan fitur media sosial sekaligus pembayaran. Dalam menjalankan produk tersebut, muncul beberapa kendala dan risiko operasional yang belum tertangani dengan baik, serta tidak sedikit pengguna yang belum teredukasi dengan baik dalam penggunaan aplikasi ini. Penelitian ini bertujuan untuk mengidentifikasi prioritas risiko dan tindakan korektif yang harus dilakukan dengan menggunakan metode MAFMA. Caranya adalah dengan mendeteksi titik-titik kegagalan yang memiliki potensi besar untuk diatasi. Kemudian mendapatkan hasil dan manfaat dari metode analisis yang akan mempengaruhi perusahaan yang menggunakan metode tersebut. Dari metode tersebut, risiko dengan nilai tertinggi berada pada nilai risiko P10, yaitu 0,482. Sedangkan risiko terendah berada pada risiko P1 dengan nilai tingkat risiko 0,251. Kemudian dari metode ditemukan resiko dengan nilai resiko tertinggi pada P10, sarannya halaman daftar terpisah dari teman-teman yang menggunakan link referral pengguna sudah terpasang foto profil.

Kata kunci: *MAFMA, Analisis Resiko, Media Sosial*

Abstract

MyBeb is a social payment application owned by one of the FinTech companies in the Sidoarjo area, East Java Province. Mybeb itself is an application that provides social media features as well as payments. In running the product, several obstacles and operational risks arise that have not been handled properly, and not a few users have not been properly educated in the use of this application. This study aims to identify risk priorities and corrective actions that must be taken using the MAFMA method. The method is to detect failure points that have great potential to be overcome. Then get the results and benefits of the analysis method that will affect the company using the methods. From the methods, the risk with the highest value was at the risk of the P10 value, which was 0.482. At the same time, the lowest risk is at P1 risk with a risk level value of 0.251. Then from the method found that the risk with the highest risk value on P10, the suggestion is that a separate page list of friends who use the user's referral link had already installed a profile photo.

Keywords: MAFMA, Risk Analysis, social media

1. Introduction

Information Technology is continuously growing every year with an increasingly widespread internet connection so that a lot of information technology users are connected to form a social network. Currently, people use these social networks with the help of social media such as *Instagram* and *Facebook* just to show their latest presence and find friends. In addition, regarding developments in information technology, there is Financial Technology (FinTech). In this FinTech, there are types of payments useful for bill payments with information technology facilities. Mobile-based applications are

one of the information technologies that provide convenience for users so that users can use many applications based on their needs, including social needs and financial needs. Although there are operations behind this application in every running mobile application, such as servers and operational policies of this application, there are many causes for a failure system that overwhelms the operational department so that it affects operational costs [1]. In another case, we cannot know about the use of this application, whether it follows the user's wishes or not.

The production process has obstacles, namely the high potential defect in the product and the broader market share, an increase in productivity is necessary to maintain product performance [2]. Therefore, conducted an initial risk identification, showing that there are 23 operational risks contained in the sugar production process at *PG Kebon Agung*. Based on calculations using the MAFMA method for risk level, the results of the critical risk are nine risks and are operational in the sugar manufacturing process. Some of the effects of the essential risks obtained in this study are such as sugar raw materials, engine damage, and work accidents [3].

Multi-Attribute Failure Mode Analysis is expected to be able to overcome product defect problems by getting the highest priority of risk to be used as a reference for recommendations for improvement actions. Researchers conducted a study using the method to help determine the highest weight for defects in gallons of drinking water originating from the cause of the design defect of the Blow Pin with an imperfect design, the weight obtained with a value of 0.234. From these results, obtained recommendations for corrective actions for the cause of the highest defects so that they can be repaired immediately [4].

The application of this method is eliminating and reducing the occurrence of failures when viewed from the cause of failure (A case study of the *Sekar Tanjung East Java*, *Pusat Koperasi Induk Susu* (*PKIS*)) states that the cause of failure of one of the production processes in the case study has contribution weight 0.47 or 47% of all criteria. Thus, the results of this study suggest the company for one such production process to minimize or eliminate failures in this process [5]. Therefore, the method is used in research to identify and prioritize risks from the operational *MyBeb* application because from the previous research that was collected, several research gaps were found in the study. The research gap is that there is no use of Multi Attribute Failure Mode Analysis (MAFMA) in the information technology industry in the financial technology sector to analyze operational risk and risk selection.

2. Method

MAFMA or Multi-Attribute Failure Mode Analysis is a method developed by Marcello Braglia to overcome the weaknesses found in FMEA. The analysis technique developed from FMEA is this method, an analytical approach used to determine the causes of potential failures [6]. During the failure analysis, the method takes into account the various criteria that must be taken into account, and the practical difficulties in FMEA application related to the “live” evaluation/quantification of the different factors, then based on the Analytic Hierarchy Process (AHP) technique which integrates aspects of the original FMEA and economic considerations. In short, AHP provides a framework for dealing with various criteria situations involving intuitive, rational, qualitative, and quantitative aspects. Then, evaluate the final rating for each cause of failure. The effect of each possible cause of failure is evaluated in terms of a function of four performance criteria: chance of failure, possibility of not being detected, failure severity, and expected costs.

Evaluation of each attribute obtained differently, if possible, defining a rational method for measuring a single criterion for each cause of the error, based on a series of Tables. Specifically, each factor is divided into different grades that are scored differently (in the range of 1 to 10) to account for different levels of criticality. The score is then determined according to the experience of the maintenance personnel staff. Alternatively, if the "Quantitative" analysis of the attributes evaluated is too tricky and unclear by the expert, qualitative pairwise comparisons between the various causes of error concerning the analyzed criteria have been adopted.

In points 1 – 3, the use is the same as the FMEA method; for point 4, there is its way because the economic aspect of a failure is calculated using a qualitative pairwise comparison. This choice is because the expert is not able to make a proper evaluation. Must consider two aspects to obtain a reliable

"score table" based on a linguistic assessment of failure costs: maintenance personnel, spare parts, "domino effect," non-compliance with the resulting product, and so on. Then, many aspects that can affect the cost of failure are added to the available data. The pairwise comparison approach carried out in the evaluation by the expert is certainly not appropriate.

The MAFMA method has the following steps: Calculate FMEA, Analytical Hierarchy Process (AHP), calculation of AHP in determining the weight of risk incident based on the expected cost Criteria [6].

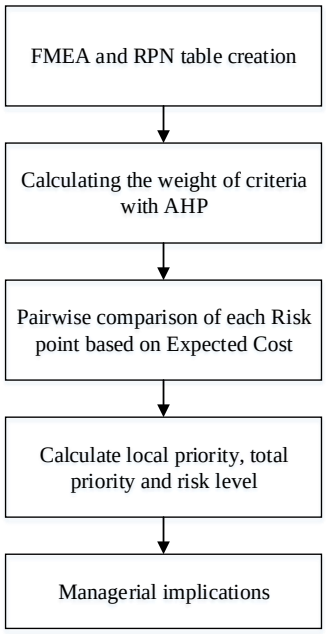

Figure 1. Flowchart of MAFMA Implementation

3. Results and Discussion

3.1. Calculate FMEA

Table 1. FMEA Risk Incident

No	Failure Probability	Severity	Occurrence	Detection	RPN
1	Menu deals blank screen	7	2	2	28
2	The addition of gift likes and comments is not real-time	5	9	5	225
3	The username that is always used at the time of registration	5	8	7	280
4	Open old deals menu	10	5	6	300
5	Transaction failed to process	6	8	2	96
6	User failure to get OTP	6	3	8	144
7	Was unable to post video or image	3	2	7	42
8	Failed to exchange gifts because the user is blocked	9	4	5	180
9	Chat not sent	6	3	6	108
10	Spread the referral link, but when a friend uses it, you don't get a referral gift	9	7	4	252
	AVERAGE	**6,6**	**5,1**	**5,2**	**165,5**

The FMEA method is used to identify each event's source and the root cause that may pose a risk. After identifying the impact, cause, and initial control of each risk event, weighting is carried out based on three criteria: Severity, Occurrence, and Detection. The weight of each criterion is assessed by

the expert based on the scoring table. Then, the Risk Priority Number (RPN) value is obtained from the multiplication of the weight values of the Severity, Occurrence, and Detection criteria. In risk events with more than one impact, the RPN value is obtained by averaging the weighted criteria. The results of the calculation of the risk value using the FMEA method can be seen in Table 1.

3.2. Analytical Hierarchy Process (AHP) Calculation

AHP calculations are carried out to determine priorities and determine the consistency of the results of the pairwise comparison test. In this case, two types of calculations are carried out using the AHP method, namely calculating the weights of the four criteria (Severity, Occurrence, Detection, and Expected Cost) and calculating the importance of risk events Expected Cost criteria. Two experts carry out the determination of the scale on the AHP by each expert comparing the criteria scale of Severity, Occurence, Detection, and Expected Cost with a scale according to the table 2.

Table 2. Illustration of the calculation of each weight

9	8	7	6	5	4	3	2	1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9

Then do the geometric average to get a single value that can represent the two experts. They chose these experts because they are parties who understand the entire process in the application under study.

3.2.1. Determine the Severity, Occurrence, Detection, and Expected Cost Criteria Scale

After determining the scale, a comparison is made for each criterion, the value of each comparison is shown in table 3.

Table 3. Comparison Score

	Severity	**Occurrence**	**Detection**	**Expected Cost**
Severity	1,00	0,76	0,24	0,17
Occurrence	1,32	1,00	1,73	0,38
Detection	4,17	0,58	1,00	1,00
Expected Cost	5,88	2,63	1,00	1,00
Total	**16**	**4**	**4**	**2**

After obtaining the paired matrix score, the score is normalized using the following formula [7]:

$$N_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ji}} \quad (1)$$

The results of the paired matrix normalization are shown in table 4.

Table 4. Paired Matrix Normalization Results

	Severity	**Occurrence**	**Detection**	**Expected Cost**
Severity	0,0608	0,1722	0,0605	0,0704
Occurrence	0,0800	0,2266	0,4360	0,1573
Detection	0,2533	0,1310	0,2520	0,4138
Expected Cost	0,3576	0,5964	0,2520	0,4138

3.2.2. Determine the Priority Weight or Eigen vector

Priority Weight or Eigenvector is obtained by dividing the total weight of each criterion or also called the Total Weight Matrix by the total number of the Total Weight Matrix using the following formula [6]:

$$W_i = \frac{\sum_{j=1}^{n} Nij}{n} \quad (2)$$

The results of the Eigen Vector matrix comparison value above are shown in Table 5

Table 5. Results Eigen Value Vector Matrix Comparison

	Severity	Occurrence	Detection	Expected Cost	Total Weight Matrix	Eugen Vector
Severity	0,0608	0,1722	0,0605	0,0704	0,3639	0,0925
Occurrence	0,0800	0,2266	0,4360	0,1573	0,8999	0,2288
Detection	0,2533	0,1310	0,2520	0,4138	1,0502	0,2670
Expected Cost	0,3576	0,5964	0,2520	0,4138	1,6199	0,4118
Total	**1**	**1**	**1**	**1**	**4**	**1**

3.2.3. Determine the Consistency Ratio (CR)

CR (Consistency Ratio) is the result of a comparison between the Consistency Index (CI) and the Random Index (RI). If CR <= 0.10 (10%), it means that the user's answer is consistent so that the resulting solution is optimal. The steps in finding the CR value are as follows [7,8,9,10]:

Matrix Multiplication

$$\begin{bmatrix} 0{,}0608 & 0{,}1722 & 0{,}0605 & 0{,}0704 \\ 0{,}0800 & 0{,}2266 & 0{,}4360 & 0{,}1573 \\ 0{,}2533 & 0{,}1310 & 0{,}2520 & 0{,}4138 \\ 0{,}3576 & 0{,}5964 & 0{,}2520 & 0{,}4138 \end{bmatrix} x \begin{bmatrix} 0{,}0925 \\ 0{,}2288 \\ 0{,}2670 \\ 0{,}4118 \end{bmatrix} = \begin{bmatrix} 0{,}0901 \\ 0{,}2404 \\ 0{,}2911 \\ 0{,}4072 \end{bmatrix} \quad (3)$$

Divide the calculation result

$$D = \frac{0{,}0901 \quad 0{,}2404 \quad 0{,}2911 \quad 0{,}4072}{0{,}0925 \quad 0{,}2288 \quad 0{,}2670 \quad 0{,}4118} = 0{,}9745 \quad 1{,}0509 \quad 1{,}0904 \quad 0{,}9889 \quad (4)$$

Calculating λ maximum

$$\lambda \text{ Max} = \frac{0{,}9745 \quad 1{,}0509 \quad 1{,}0904 \quad 0{,}9889}{4} = 1{,}02616 \quad (5)$$

Calculating the Consistency Index (CI)

$$CI = \frac{1{,}0261-4}{4-1} \quad (6)$$

Calculating Consistency Ratio (CR)

The size of the matrix used is 4, then the value of the IR is 0.9

$$CR = \frac{-0{,}9998}{0{,}9} = -1{,}1014 \quad (7)$$

From the above calculation, the Consistency Ratio (CR) value is -1.1014; where the value is less than 0.1, the comparison between the four criteria is consistent and justifiable.

3.3 Calculation of Multi-Attribute Failure Mode Analysis (MAFMA)

Calculation of risk value using the MAFMA method involves four specific criteria: Severity, Occurrence, Detection, and Expected Cost. There are two types of values that are considered, namely

Local Priority and Total Priority, to get the final risk value. Local Priority is obtained from the division between the RPN value for each risk event and the total RPN for all-risk incidents from table 1.

$$Local\ priority = \frac{Risk\ value}{Total\ Risk\ Value} \quad (8)$$

Meanwhile, each criterion has a value called Global Priority, which is the weight value obtained from the weighting of the criteria using the AHP method from table 5.

$$Global\ Priority = Total\ Weight\ Criteria\ Risk \quad (9)$$

Then, the multiplication between Local Priority and Global Priority produces the Total Priority value.

$$Total\ priority = Local\ priority\ x\ Global\ Priority \quad (10)$$

Then, the Total Priority value for each risk event in each criterion is summed and produces the Risk Level value for each risk event.

$$Risk\ Level = \sum Global\ Priority\ (Severity, Occurence, Detection, Expected\ cost) \quad (11)$$

Risk Level value can be seen in Table 6.

Table 6. Risk Level Value on Risk Incident

Alternative	Risk Level
1. Menu deals blank screen (P1)	0,251
2. The addition of gift likes and comments are not real-time (P2)	0,460
3. Username that is always used at the time of registration (P3)	0,467
4. Open old deals menu (P4)	0,393
5. Transaction failed to process (P5)	0,317
6. User failure to get OTP (P6)	0,390
7. Failed to post video or image (P7)	0,345
8. Failed to exchange gifts because the user is blocked (P8)	0,392
9. Chat not sent (P9)	0,435
10. Spread the referral link, but when a friend uses it, you don't get a referral gift (P10)	0,482

Based on the results of the method, the risk level value of each risk is obtained. The risk with the highest value is the risk of the P10 value, which is 0.482. At the same time, the lowest risk is P1 risk with a risk level value of 0.251.

3.4 Managerial Implication

In research using MAFMA in the *MyBeb* application case study, developers can use the results in determining managerial policies in overcoming risks. The next step to reduce the number of possible failures is to propose improvements to the company that houses *MyBeb*. The method approach can identify the most critical causes of loss by looking at the highest weight. Then, from the recap of the method score, can be taken several alternative improvements.

Based on the weighting ranking, I will explain several proposed corrective actions to the development process following the conditions of the company that oversees *MyBeb* itself. The following describes the risk points with suggested managerial steps that must take: 1) Proposed improvements for menu deal blank screen (P1). The proposal is to improve the deals menu blank screen so that it is not smooth for users to access the payment feature due to various factors, such as the user's internet connection being unstable because the menu uses a web page instead of using the native display of the

Android mobile application by changing the entire deals menu from the page. As a result, the web becomes a native page for the *Android* mobile application. The assets from the payment menu display are organized and can appear without being affected by the user's lack of stability on the internet. 2) Spread the referral link, but when a friend uses it, they don't get a referral gift (P10). The proposed improvement for this point is to provide a special page for a list of friends who use a referral link from the customer whether they have done the activity of installing a profile photo. Because the requirement to get a referral gift is to upload a profile photo first. More information is also needed on applications and education that can be spread on social media owned by MyBeb marketing.

4. Conclusion

The identification of risk points obtained as many as ten risk points that may occur in the running operations of the *MyBeb* Application. The risk analysis results using Multi-Attribute Failure Mode Analysis (MAFMA) on the risks that arise in the operational and technical aspects of the *MyBeb* application, the risk level values for each chance are obtained. The risk with the highest score is the risk of the P10 value, which is 0.482. At the same time, the lowest risk is P1 risk with a risk level score of 0.251. Then from the method found that the risk with the highest risk value was spreading a referral link, but when a friend used it, it did not get a referral gift. The suggestion is that a separate page list of friends who use the user's referral link had already installed a profile photo. The results of the risk analysis on the Mybeb application can be considered as suggestion so that the risk points that have been identified can be detected faster until they are resolved properly

References

[1] Suprapto W, Tarigan Z J H and Basana S R 2017 The influence of ERP system to the company performance seen through innovation process, information quality, and information sharing as the intervening variables. ICEMT. 17 87-91

[2] Mustakim, Soeparman, S and Surachman 2015 Implementation of lean six sigma, multi-attribute failure mode analysis, and fuzzy analytic hierarchy process to identify causes of potential defects in particleboard products. *Journal of Engineering and Management in Industrial System*. 3 22-27.

[3] Dagmar A V, and Tarigan Z J H 2021 The application of the Six Sigma method in reducing the defects of welding on the steel material IOP Conf. Ser.: Mater. Sci. Eng. 1010 012044

[4] Ellington M S D and Nurcahyo Y E 2019 Implementation of Multi-Attribute Failure Mode Analysis in the Production Process of Gallons of Drinking Water at PT. XYZ. *Teknika Engineering and Sains Journal*. 3 31-36.

[5] Rucitra A L 2018 Application of multi-attribute failure mode analysis of milk production using analytical hierarchy process method. *IOP Conf. Ser Earth Environ*, Sci. 131 012022.

[6] Kristyanto R., Sugiono and Yuniarti R. 2015 Operational Risk Analysis in Sugar Production Process Using Multi-Attribute Failure Mode Analysis (MAFMA) Method (Case Study: Pg. Kebon Agung Malang). *Jurnal Rekayasa dan Manajemen Industri*. 3 592-601

[7] Alkhalidi A, Tahat S, Smadi M, Migdady B, and Kaylani H. 2020 Risk assessment using the analytic hierarchy process while planning and prior to constructing wind projects in Jordan. *Wind Engineering*. 44 282-293

[8] Aminbakhsh S, Gunduz M and Sonmez R 2013 Safety risk assessment using analytic hierarchy process (AHP) during planning and budgeting of construction projects. *Journal of safety research*. 46 99-105

[9] Akmaludin 2016 Paired Matrices Determination in the Analytic Hierarchical Process (AHP) with Appeal Scale Value Method Approach. *Bina Insani ICT Journal*. 3 243 - 252.

[10] Munthafa AE and Mubarok H 2017 Application of the analytical hierarchy process method in the decision support system for determining outstanding students. *Jurnal Siliwangi Seri Sains dan Teknologi*. 3 192-201