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How to choose the best promotion strategies for increasing prospective students: The role of risk management factors

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ABSTRACT

X University is one of the private universities located in the East Java province. To retain prospective students and encourage them to register, informational media through promotion is necessary. To determine the best promotion strategy, student profile data is utilized. The accumulated student profile data must be processed through data mining. In this research, the K-means method is used for data mining. The K-means measurement results are divided into three groups: Cluster 1 includes P1, P7, and P8; Cluster 2 includes P2 and P9; and Cluster 3 includes P3, P4, P5, P6, and P10. The risk management process is carried out in three stages: risk identification, risk assessment, and risk mitigation. The results of the risk identification phase showed that there were 15 risk variables. The risk assessment phase revealed two very high category risks, two high category risks, four medium category risks, and seven low category risks. Following the advice of X University, risk mitigation activities were selected for the very high and high-category risk variables. The results of this research are expected to contribute to an increase in the number of students at X University in the future.

1. Introduction

Promotional activities are an effective way to introduce higher education institutions, including those carried out by X University on a yearly basis to influence student decisions about applying. Due to frequent competition in terms of promotion between tertiary institutions, support for promotional costs is necessary, especially when activities take place outside the city or even the province [1]. Proper planning is essential and can be aided through increased computational capacity and storage media upgrades [2]. The existence of this capacity is useful in obtaining information related to student profiles, such as achievement index, which can be utilized to segment prospective students [3] and determine admission strategies for the next period [4], [5].

The selection of the right strategy is crucial to ensure that policy courses are effective and efficient. Good policies should be tailored to student data [6], which can be processed through a data clustering process [7]. The existence of student data clusters serves as a benchmark for the balance of higher education institutions against their facilities, such as infrastructure, lecturers, and educational staff [8], [9].

The completeness of facilities can be utilized as a means of promotion to attract students, but this step may not always be effective in increasing the number of students who continue their studies [10]. The cause of this could be due to uneven dissemination of information received by prospective students [11]. The industrial engineering study program at X University has also experienced uneven dissemination of information to prospective students during promotional activities. As seen in Figure 1, the number of students who apply fluctuates each year, indicating a lack of consistency in promotion strategies.

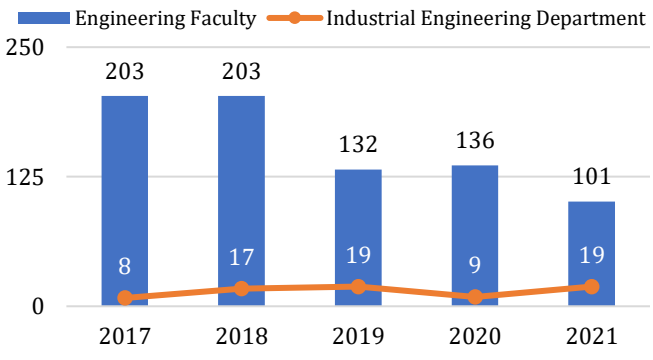

Figure 1. Student number data for 2018-2021

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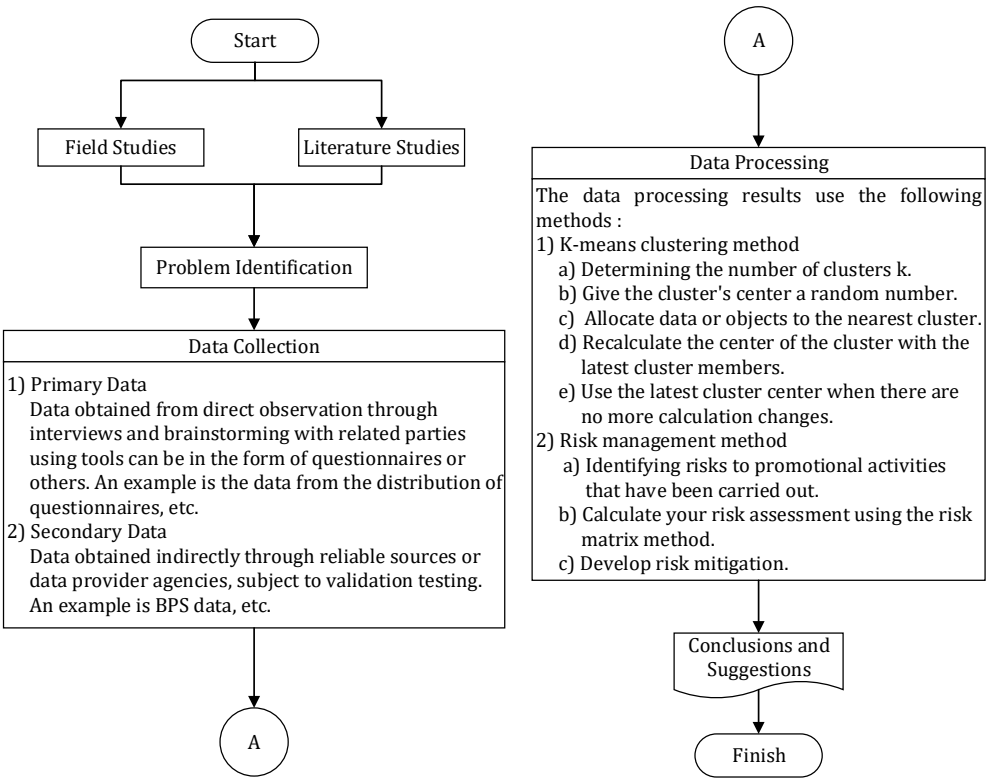

Figure 2. Research stages

The program has been using the same process for promotion failures [12] without analyzing historical data from previous years, such as the data of prospective students from registration to acceptance [13]. Proper processing of student data can reveal useful information [14]. To improve data accuracy and reduce manual observation errors [15], a clustering model needs to be built immediately. The results of the grouping are expected to contribute to the segmentation of promotions. Many promotional segmentation activities from previous research have proven ineffective in the current environment.

Promotional activities are often carried out incidentally or randomly through school visits [16]. Without a priority scale, the results are not always effective. Determining a priority scale is difficult due to data buildup in the database system [17], which needs to be processed to provide added value [18]. However, promotion executives often prefer not to read complicated data, leading to the imitation of previous activities with questionable results. Gradual and selective revamping of promotional activities is necessary to avoid overburdening the operational costs of the institution [19].

To address this issue, a study was conducted on the segmentation of promotional activities, considering risk factors. In-depth analysis is necessary for segmentation activities to reduce risk [20]. Risk management activities are carried out using a dataset of promotion strategies [21] and by interpreting active student data [22]. Through this research, the aim is to create segmentation that aligns with promotion targets. Proper promotion planning based on prospective students' behavior is critical to succeed in today's fiercely competitive environment [23], [24].

2. Method

2.1. Research stages

This research is categorized as quantitative research. The results of quantitative research are related to the use of numbers from collection to research results [25] accompanied by statistical testing [26]. This research deals with the determination of promotional strategies by considering risk factors. The problem-solving process is carried out in a series of stages. The stages of this research are arranged systematically and sequentially so that objective results are obtained. The form of support for objectivity in this research is through the sequence shown in Figure 2. The stages of research are explained as follows:

1) Field studies and literature studies.
   Research activities begin with field studies and literature studies. The purpose of field studies and literature studies is to find out the conditions that occur in the field by paying attention to literature reviews that are in accordance with the topic of the problem under study.
2) Problem identification.
   The findings of field studies and literature reviews are useful in identifying problems. The problem identification stage aims to obtain phenomena that have the potential to be researched through measuring problems based on research procedures.
3) Data collection.
   The results of identifying the problem become a reference in the data collection stage. The data collection process is carried out by direct or indirect observation. The results of data collection

included primary and secondary data. Examples of primary data are data on the results of questionnaires, etc. Examples of secondary data are BPS data, etc.

4) Data processing.
The results of data collection are measured in data processing. The data processing stages are carried out in two stages.
   a) The first stage is to perform the calculation of k-means clustering. The goal of calculating k-means clustering is to divide data into several clusters based on degree of similarity and characteristic similarity.
   b) The second stage is to carry out risk management for actions related to aspects of promotion. The method of conducting risk assessment uses a risk matrix.

5) Conclusion and suggestions.
If the two stages of data processing have been completed, the next stage is conclusion and suggestions. The conclusion and suggestion stages provide an overview of the entire research stage, accompanied by an explanation of the shortcomings of the research and improvements to the continuation of the research that must be carried out.

2.2. K-means

K-Means is a method for grouping data, and it produces clusters of data [27]. Clustering involves grouping data that have similar characteristics and is categorized as unsupervised learning [28]. Figure 3 illustrates the concept of clustering [29].

K-Means can be helpful in terms of categorization as well as the classification of objects. The process of categorizing and classifying objects based on attributes into k groups where k is positively valued [30]. The K-Means calculation step is carried out through several stages, including [31]:

1. Determination of the number of clusters K and initial centroid.
2. Calculation of the distance of each object to the centroid.
3. Grouping objects according to the minimum distance to the centroid.
4. Re-determination of centroids in the event of cluster switching by calculating the average value of all members of each cluster.
5. Iterate through stages 1–4 until no more cluster switching occurs.
6. The calculation is stopped if all records present on each central cluster remain in that cluster.

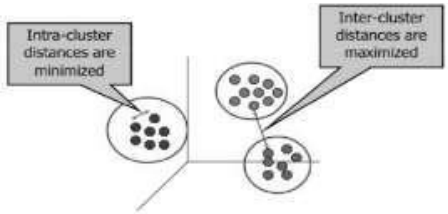

Figure 3. Clustering concept

Table 1.
Risk mapping

Likelihood	Impact				
	1	2	3	4	5
5	Medium	High	Very High	Very High	Very High
4	Medium	High	High	Very High	Very High
3	Low	Medium	High	High	Very High
2	Low	Low	Medium	Medium	High
1	Low	Low	Low	Low	Medium

2.3. Risk matrix

Promotional activities cannot be separated from the risks that occur. Risk management needs to be studied further [32] because promotional activities are dynamic, so they are full of uncertainty. The occurrence of uncertainty about risk sometimes has to be faced because, when managed properly, risks will not lead to a reduction in outcomes [33]. The environment at risk for an event can be used to identify both outcomes and possibilities [34]. The environment within the scope of higher education institutions needs to have the ability to anticipate and prepare for change rather than waiting for it and then reacting [35]. As a result, risk management is critical in mitigating based on knowledge and understanding [36].

One method for measuring risk the risk matrix. The risk matrix method is used in risk assessment so that it can determine what actions should be taken [37]. Table 1 shows the mapping results of risk assessment using a risk matrix [38]. Risk assessment parameters in the risk matrix method use the classification of likelihood and impact criteria [39] based on 4 zones, as follows:

a) The very high-risk category enters the "red zone." The risk value in the red zone ranges from 12 to 25. Immediate action is required in the event of a very high category risk.
b) The high-risk category falls into the orange zone. The risk value in the orange zone is in the range of 8 to 12. It is necessary to control risks in the event of high-category risks.
c) The moderate-risk category enters the yellow color zone. The risk value is in the yellow zone at intervals of 5 to 8. If there is a possibility of resource availability in the event of a moderate category risk, action is taken.
d) The low-risk category enters the green zone. The risk value in the green zone ranges from $X \leq 4$. There is no need to act because it is still acceptable in the event of a low-category risk.

3. Results and discussions

This research was carried out fromOctober 1, 2022, to December 31, 2022. Data collection was carried out during promotional activities of the Faculty of Engineering, X University, during promotional visits at senior high schools. Data collection for promotional activities is limited to nine districts or cities, with a total of 100 samples in each region. Table 2 shows the respondent data obtained from the data collection process.

Table 2.
Data from research respondents

Area	School		Gender	
	High School	Vocational	Man	Women
Bojonegoro District	54	46	32	68
Nganjuk District	48	52	44	56
Ngawi District	60	40	58	42
Ponorogo District	75	25	70	30
Pacitan District	44	56	36	64
Magetan District	65	35	48	52
Trenggalek District	52	48	56	44
Madiun District	50	50	65	35
Madiun City	72	28	55	45
Total	520	380	464	436

Table 3.
Standarization results from questionnaire data

Area	Promotion			
	P1	…	…	P10
Bojonegoro District	-0,05	…	…	-1,07
Nganjuk District	-0,13	…	…	-1,22
Ngawi District	0,78	…	…	-1,37
Ponorogo District	-1,04	…	…	0,13
Pacitan District	0,71	…	…	1,03
Magetan District	-1,95	…	…	1,03
Trenggalek District	-0,28	…	…	-0,17
Madiun District	1,09	…	…	0,88
Madiun City	0,86	…	…	0,73

Table 3.
Cluster centroids

Variable	Cluster 1	Cluster 2	Cluster 3	Grand Centroid
P1	-0,392	0,177	0,860	-0,000
P2	0,226	0,341	-2,270	-0,000
P3	0,751	-0,719	-0,131	0,000
…	…	…	…	…
P8	-0,543	0,685	-0,569	-0,000
P9	0,236	0,236	-1,885	-0,000
P10	0,209	-0,392	0,734	0,000

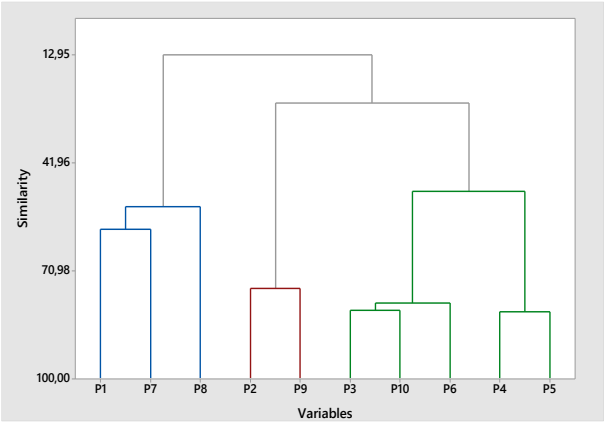

Figure 4. Cluster result dendogram

The data processing stage begins with clustering K-means. K-means clustering aims to assist in the grouping of data based on the similarity of objects by maximizing the dissimilarity of different clusters. The K-Means calculation process is based on questionnaire data that is distributed when promoting in the scope of senior high school and vocational school.

Table 4.
Distances between cluster centroids

	Cluster 1	Cluster 2	Cluster 3
Cluster 1	0,000	3,245	3,931
Cluster 2	3,245	0,000	4,362
Cluster 3	3,931	4,362	0,000

Table 5.
Risk identification results

Code	Risk Variable
RV_1	Additional promotional costs.
RV_2	Students do not increase.
RV_3	Not on target.
RV_4	Failure to create a brand.
RV_5	Failure in the development of a new promotion strategy.
RV_6	The emergence of competing colleges.
…	…
RV_{11}	The teaching process has not been optimised for innovation.
RV_{12}	College policy is inconsistent.
RV_{13}	There is an improvement in the quality of graduates.
RV_{14}	Economic conditions are uncertain.
RV_{15}	Decline in public trust.

Table 6.
Likelihood and impact scale values

Score	Likelihood	Impact
5	Almost certainly	Losses will be huge
4	Most likely to happen	Big losses
3	Possibilities may occur	Medium losses
2	Less likely to occur	Small losses
1	Rare	Negligible

Table 7.
Risk assessment results

Risk Variable	Value		Risk Level	Assessment Scale
	Probability	Impact		
RV_1	1	1	1	Low
RV_2	2	3	6	Medium
….	….	….	….	….
RV_{13}	1	3	3	Low
RV_{14}	5	1	5	Medium
RV_{15}	2	1	2	Low

Table 8.
Risk matrix results

Likelihood	Impact				
	1	2	3	4	5
5	RV_{14}	RV_5			
4		RV_4		RV_7	
3	RV_6	RV_{12}			RV_{13}
2	RV_{15}	RV_9	RV_2	RV_{11}	
1	RV_1	RV_8	RV_{10}	RV_3	

The questionnaire results are shown in Table 3. The process of categorizing data based on the type of promotion that is most effective. The types of promotions that will be carried out include the provision of internal institutional scholarships (P1), participating in campus expo activities (P2), institutional social media development (P3), addition of

teaching support facilities (P4), introduction of alumni networks that are already working (P5), notification of student achievement (P6), coverage of the teaching system (P7), news of cooperation networks both at home and abroad (P8), ease of student registration services (P9), and the existence of accreditation for both institutions and study programs (P10).

The cluster test results are presented in Figure 4, showing that the data were grouped into three clusters. Cluster 1 consists of P1, P7, and P8; Cluster 2 includes P2 and P9, while Cluster 3 consists of P3, P4, P5, P6, and P10. The cluster centroid values are reported in Table 4, with P2 variable having the highest value of 2.27 in Cluster 3.

The distances between centroid clusters are presented in Table 5, and the closest distance is found between Cluster 1 and Cluster 2, with 3.245. These K-means test results can be used to identify possible risks associated with promotional activities. By considering the clusters formed by the data, risk management can be better informed, and assessment of potential risks can be conducted more effectively.

The risk management process is carried out after the results of the promotion cluster are known. Risk management activities begin with identifying risks. During the implementation of promotional activities at X University, the risk identification process is carried out. Parties involved in the promotion are given a questionnaire about promotional problems that have occurred or may occur. A total of 54 people from 27 majors at X University responded to the questionnaire. Table 6 shows the results of the risk identification process. The results of the risk identification process show that there are 15 potentially risky activities.

The findings of the risk assessment are then implemented. The risk assessment stage is based on the likelihood and impact levels in Table 7. The calculation of the risk score comes from the multiplication of likelihood by impact. Table 8 is the result of calculating the risk score [40]. The results of calculating the risk score are known to have two very high-risk categories, two high risk categories, four medium risk categories, and seven low risk categories. Based on recommendations from X University, very high category risk and high category risk are considered in risk mitigation activities.

Risk mitigation activities in this study are limited to risks in the high and very high categories. Alternative risk mitigation activities can be carried out through several measures, namely risk retention, risk mitigation, risk transfer, risk avoidance, and risk sharing. These five risk mitigation activities are defined in [41]. Risk mitigation that can be done in this study includes:

1) Critical risks: Failure to create a brand.
   Causes
   - College social media is not updated.
   - Rarely participate in educational events.
   - College website has a monotonous look.

   Possibilities and contingency plan
   a) Risk avoidance
      - Active promotion through social media.
      - Create attractive logos and taglines.
      - Participating in many education-based events.
   b) Risk transfer
      - Create an attractive and informative website.
      - Using influencers.
      - Co-branding.
2) Critical risks: Failure in the development of a new promotion strategy.
   Causes
   - Not understanding the needs and target consumers.
   - Promotion planning is not good.
   - Does not monitor competitors.
   - Mismanagement of relationships with stakeholders in college.

   Probability and contingency plan
   a) Risk mitigation
      - Create a new sensible target.
      - Piloting new strategies in promotions
   b) Risk sharing
      - Determine the rate of return.
      - Involve customers in decision-making.
      - Give more time to the newly executed promotion strategy.
3) Critical risks: Incompatibility between brand and conditions in colleges.
   Causes
   - Dishonesty in promotion.
   - Preparation lacks in the determination of the promotion.

   Probability dan contingency plan
   a) Risk transfer
      – Compensate if someone is harmed.
      – Clarifying openly.
   b) Risk retention
      – Fix errors quickly.
      – Update existing brands.
4) Critical risks: The network between alumni has not been well connected.
   Causes
   - Tracer study activities are massive.
   - Do not involve alumni in promotional activities.

   Probability dan contingency plan
   a) Risk retention
      – Alumni data collection is carried out periodically.
      – Providing space for alumni association organizations.
   b) Risk avoidance
      – Providing rewards to alumni who are still active.
      – Organizing alumni gatherings at the college's dies natalis.

4. Conclusions

The conclusions that can be drawn from the analysis and discussion of the stages of data collection and processing are that there are nine promotion strategies.

The promotion strategy's results are then tested in cluster tests. The results of the K-means test formed three clusters. Cluster 1 is P1, P7, and P8. Cluster 2 is P2 and P9. Cluster 3 is P3, P4, P5, P6, and P10. The results of K-means testing allow for an impact on risk. The existence of risk is analyzed using risk management. The results of risk identification found 15 indicators of risk variables. The risk variables are then evaluated during the risk assessment process. The risk assessment yielded two very high category risks, two high category risks, four medium category risks, and seven low category risks. Risk mitigation is carried out on very high and high-category risk variables based on XYZ University's recommendations. Failure to create a brand; possibilities and contingency plans; incompatibility between brand and college conditions; and a weak network among alumni are the risk variables. Future research is expected to have cost parameters. The existence of cost parameters supports the analysis of the measurement of the bill against the cost of the selected promotion alternative.

Declaration statement

Yudha Adi Kusuma: **Conceptualization, Methodology, Supervision, Project administration**. **Data curation, Validation**, **Resources, Validation, Formal Analysis**, **Resources, Visualization, Investigation, Data curation, Validation**, **Writing - Review & Editing**.

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The authors report there are no competing interests to declare.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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