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ANALYSIS OF MODIFIED K-MEANS CLUSTERING IN DECISION SUPPORT OF INDUSTRIAL PARTNER GROUPING

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Abstract

Internship is part of achieving the competencies expected in the educational process. Therefore, the suitability of students to companies that serve as a place for street vendors is something important to pay attention to. Weaknesses in the previous system, there are still many students who are not right in choosing companies/agencies. They are still not paying attention to the competencies expected in this internship process. This study aims to help group industrial partners according to the competency achievements of each department. The method used in this research is Modified K-Means Clustering in the grouping process. While the criteria used are the suitability of the company's field with the department, credibility, company ecosystem, company track record in the field of education, and the facilities provided. In carrying out this work, a system will be developed to process the data resulting from the questionnaire so that groups from each company are obtained. The results of the study were obtained from 86 respondents who were apprentices who had been in 37 companies or agencies. 22 questions that build 7 criteria resulted in 4 stable clusters after 8 iterations.

Keywords*: internship, decision support system, Modified K-Means Clustering.*

1. Introduction

Internship activities are one of the flagship programs launched by the Ministry of Education and Culture (Kemendikbud) in increasing industrial experience and competence for students. This is because when students lack work experience in industry or the professional world, they are not ready to work immediately. This is what causes the absorption of graduates in the world of work to be low and there are still many who are still not working. Based on BPS data for 2017-2019, the unemployment rate contributed from Diploma and University graduates is as shown in table 1.1 where the number continues to increase every year.

Table 1. Open Unemployment by Higher Education

No	Higher education	2017		2018		2019
		Feb	Agt	Feb	Agt	Feb
	Diploma	249.705	242.937	300.845	220.932	269.976
	University	606.939	618.758	789.113	729.601	839.019

(Source: www.bps.go.id)

The breakthrough of the 2-semester internship program instructed by the Ministry of Education and Culture through the Kampus Merdeka program not only aims to improve student experience but also provides synergy between the industrial world to find suitable talents to recruit, thereby reducing initial selection costs. Tanah Laut State Polytechnic (Politala) as a work unit under the Ministry of Education and Culture will implement the internship program for 2 semesters in improving student competence. Related to this, professional and appropriate industrial partners are needed and can be used as places for forging student competencies. So far, students are left to choose for themselves without any selection of companies that are in accordance with their competencies. This resulted in the results of the questionnaire on the suitability of the place for street vendors and majors only showing a figure of 50%. Therefore, there is a need for a selection process for industrial partners by formulating criteria and indicators for evaluating criteria.

In this study, the process of grouping companies that will be used as industrial partners in street vendors is by using the Modified K-Means Clustering method. In terms of cluster accuracy or quality, the application of the Modified K-Means method to the grouping of centipol commentary data produces a better cluster based on the resulting purity value. In general, the Modified K-Means algorithm, which modifies the initial centroid selection, can be used to optimize the performance of the K-Means algorithm where the quality of the resulting cluster depends on the initial centroid selection [1].

Research related to decision support related to internships with the AHP and Borda methods in determining students who will be PKL has been used [2]. Firza et al in their research produced solutions or references for the division of internships in majors according to the interests and talents of eleventh graders Multimedia and Accounting [3]. Research by Talakua et al discusses the use of the Kmeans algorithm to group districts/cities in Maluku Province based on the similarity of regional characteristics in terms of the five measures of the Human Development Index (HDI) [4]. Cahyanto et al in their research said that in terms of the consistency of cluster results, where the Modified K-Means method was able to produce more consistent clusters. In terms of cluster accuracy or quality, the application of the Modified K-Means method to the grouping of centipol commentary data produces a better cluster based on the resulting purity value [1]. There is also Maulida et al who get 3 clusters in the results of their research on tourism, where C1 = the number of high tourist visits, C2 = the number of moderate tourist visits and C3 = the number of low tourist visits [5].

However, in previous research, there has been no specific grouping of industrial partners as a place for street vendors. In this study, a decision-making system will be developed using the Modified K-Means Clustering method which will produce group data on industrial partners who will be used as street vendors. The criteria to be used are the suitability of the company's field with the department, credibility, the company's ecosystem, the company's track record in

the field of education, and the facilities provided. The results obtained will help adjust the achievement standards of street vendors with existing industrial partners, so that students will get a place for street vendors that is in accordance with their competencies.

Based on the background that has been described, the formulation of the problem for this research is as follows:

a. How to implement the Modified K-Means Clustering method in the process of grouping industrial partners who will be used as internships?
b. How to analyze the results of grouping industrial partners that will be used as PKL places determined by Modified K-Means Clustering?

2. Research Method

The stages that will be carried out in conducting this research include:

2.1. Problem Identification

This process begins with identifying how to determine the main priority in selecting industrial partners to serve as internships. Analyze the criteria of the company that will be used as an internship.

2.2. System identification and settlement method

This process analyzes the system and the right decision-making method used to solve the problem of choosing an industrial partner so that the data concluded can describe the actual reality. The system used is application-based with the appropriate platform.

2.3. Literature Study

This research will be able to run according to the right decision-making rules, namely by studying the literature related to decision support systems, Modified K-Means Clustering and the stages of taking a data.

2.4. Designing and Collecting Questionnaire Data

Formulations from several journals and literature related to decision support systems are used as material for retrieval of data to users. Questionnaire design by considering the narration and parameters of the questionnaire answers. Initial data retrieval using google forms.

2.5. Data Analysis

After the data collection stage, an analysis of the spatial data will be carried out based on a literature study related to the criteria and the weights of these criteria.

2.6. Implementation of the Modified K-Means Clustering Method

This stage is by asking the experts for input on the existing criteria by comparing the priority level of each criterion to the other criteria. Furthermore, the results of the grouping will be obtained which can be used as the basis for making decisions for industrial partners who will be used as internships.

2.7. Result Analysis

The results obtained from the ranking results will be analyzed by conducting tests whether the results obtained have a large error rate. This test compares with expert input and weighting methods that are carried out without fuzzyfication.

2.8. Conclusions, Reports and Publications

This stage concludes the results obtained from the previous processes by obtaining a ranking that can be used as the basis for making decisions on the selection of industrial partners to be used as internships. Furthermore, the preparation of reports and publications to document the results of this research.

3. Result and Discussion

The results of the research that has been carried out are analyzed where the internship is in accordance with the competence of the Politala students. The next stage is distributing questionnaires from Information Technology Study Program students to the internship site. Clustering has been carried out on 84 records from the questionnaire results. The questionnaire contains 29 questions and 22 of them are questions aimed at evaluating the internship place of each questionnaire filler.

The analysis of the results of the questionnaire distribution contained 7 assessment components that were built from 22 questions on the assessment questionnaire. The seven components are the suitability of the department and company core, company credibility, company commitment, company environment, company facilities, company recommendations, and student competence after internship at the company. The results of the questionnaire were then analyzed using the Modified K-Means Clustering method to group the internship places according to the student's competence. The results of the grouping are as follows:

3.1. Cluster 1 result

Cluster 1								
Data No -	Company name	K1	K2	K3	K4	K5	K6	K7
2	BPSDMP Kominfo Banjarmasin	3	4	4	3	4	2	3
3	CV. Fast Media Komputindo	3	4	4	4	4	3	4

13	PT. Cipta Krida Bahari Logistics Banjarmasin	2	4	4	4	4	1	4
19	PT. KPP Coal Mining Rantau	3	4	3	4	4	3	3
33	Radar Banjarmasin	3	4	3	4	3	1	4
34	Sekda Tanah Laut	2	3	3	4	3	1	3
37	UP3B Sistem Kalselteng	3	4	4	3	3	1	3

3.2. Cluster 2 result

Cluster 2								
Data No -	Company name	K1	K2	K3	K4	K5	K6	K7
5	Dinas Kominfo dan Informatika Provinsi Kalimantan Selatan	4	4	3	4	3	4	4
6	Dinas Kominfo dan Informatika Tanah Bumbu	3	3	4	4	2	4	3
8	PT Phinemo Kreasi Media	5	4	4	5	3	4	3
9	PT TELKOM (AKSES) INDONESIA CENTRUM STO 2 BANJARMASIN	4	4	3	4	4	3	4
12	PT. Arutmin Indonesia Tambang Kintap	4	4	4	4	4	4	4
14	PT. Darma Henwa, Tbk-	5	5	4	4	3	4	3

Cluster 2								
Data No -	Company name	K1	K2	K3	K4	K5	K6	K7
15	ACP PT. Gagah Putera Satria	4	4	5	4	3	4	3
16	PT. Geoinfo Teknologi	4	4	5	5	3	4	4
18	PT. Jhonlin Group	5	4	4	4	4	4	3
20	PT. Mitra Megah Profitamas	4	4	3	4	3	4	3
21	PT. PAMA Persada Nusantara	4	4	0	5	5	4	4
22	Distrik Aria Kintap PT. PLN (Persero) Unit Induk Wilayah Kalimantan Selatan dan Kalimantan Tengah Unit Bidang Oprasional STI Kalsel dan Kalteng	4	4	4	5	4	4	4
24	PT. PLN (Persero) UPK Asam Asam	4	4	4	5	4	4	4
29	PT. Trio Motor	5	4	4	4	3	4	4
31	PT. United Tractors-Tbk Sites Satui	4	4	4	4	4	4	4
32	PT.BORNEO INDOBARA	4	4	3	3	3	4	3
35	Telkom Banjarmasin Centrum	4	4	4	4	3	4	3

3.3. Cluster 3 result

Cluster 3								
Data No -	Company name	K1	K2	K3	K4	K5	K6	K7
1	Angkasa Pura I (Persero) Cabang Bandara Syamsudin Noor	4	4	5	5	4	4	4
4	Dinas Kominfo dan Informatika Banjarbaru	4	4	4	5	4	4	4
7	DISKOMINFO KAPUAS	5	5	5	5	5	5	4
10	PT United Tractors Tbk Cab Banjarmasin	4	5	4	4	4	4	4
11	PT. Amanah Anugrah Adi Mulia	4	4	4	5	4	5	4
17	PT. Indonesia Comnets Plus	4	4	5	4	5	5	3
23	PT. PLN (Persero) Unit Induk Wilayah Kalimantan Selatan dan Kalimantan Tengah Unit Pelaksana Pelayanan Pelanggan Banjarmasin Unit Layanan Pelanggan Banjarbaru	3	4	4	5	4	4	4
25	PT. PLN(Persero) Unit Induk Pembangkitan dan	4	5	5	5	5	5	4

Cluster 3								
Data No -	Company name	K1	K2	K3	K4	K5	K6	K7
26	Penyaluran Kalimantan UPDK Barito ULPLTA Ir. P.M.Noor PT. Putra Perkasa Abadi	4	5	4	5	5	4	4
27	PT. Sucofindo Banjarmasin	4	4	4	5	5	4	5
28	PT. Sumber Berlian Motor Banjarmasin (Mitsubishi)	3	4	3	5	5	4	3
36	Toyota Auto2000 Banjarmasin	3	5	4	5	5	5	3

3.4 Cluster 4 result

Cluster 4								
Data No -	Company name	K1	K2	K3	K4	K5	K6	K7
30	PT. United Tractors-Tbk sites Rantau	3	5	5	5	5	5	4

3.5 Proximity table to cluster center

Data No -	**C1**	**C2**	**C3**	**C4**	**Cluster**
1	3,18	1,24	1,09	2,66	3
2	0,67	2,45	3,22	4,56	1
3	1,60	1,77	2,32	3,54	1
4	3,14	1,27	0,59	2,24	3
5	2,67	0,84	2,05	3,66	2
6	2,71	1,94	3,05	4,46	2
7	4,98	2,86	1,75	2,17	3
8	3,46	1,12	2,02	3,84	2
9	2,18	1,55	2,10	3,74	2
10	3,09	1,25	0,80	2,37	3

11	3,85	1,56	0,85	2,26	3
12	2,83	0,83	1,27	2,88	2
13	1,74	3,79	3,92	4,65	1
14	3,42	1,08	1,97	3,70	2
15	2,95	0,92	1,74	3,42	2
16	3,06	1,07	1,55	3,06	2
17	4,10	2,03	1,41	2,73	3
18	3,34	0,98	1,90	3,77	2
19	1,60	1,84	2,49	3,98	1
20	2,72	0,89	2,15	3,97	2
21	4,57	4,01	4,27	5,47	2
22	2,87	0,73	1,08	2,85	2
23	2,78	1,63	1,10	2,26	3
24	2,91	0,76	1,02	2,82	2
25	4,39	2,38	1,07	1,55	3
26	3,71	2,26	0,98	1,81	3
27	3,47	1,97	1,08	1,95	3
28	2,92	2,11	1,94	3,28	3
29	3,27	1,08	2,26	3,95	2
30	4,29	2,84	1,47	1,08	4
31	2,80	0,79	1,09	2,91	2
32	2,92	1,81	3,03	4,68	2
33	1,10	3,34	4,23	5,48	1
34	1,71	4,07	4,96	6,24	1
35	2,79	0,63	1,72	3,41	2
36	3,78	2,17	1,22	2,14	3
37	1,21	3,43	4,28	5,53	1

From the table of proximity to the center of the cluster above, it can be seen that the 4 clusters created are clusters with good proximity to the center of the cluster. This shows that the division of companies into 4 clusters can be an ideal division in choosing an internship place for students.

4. Conclusion

Clustering has been carried out on 84 records from the questionnaire results. The questionnaire contains 29 questions and 22 of them are questions aimed at evaluating the internship place of each questionnaire filler. The analysis of the results of the questionnaire distribution contained 7 assessment components that were built from 22 questions on the assessment questionnaire. The seven components are the suitability of the department and company core, company credibility, company commitment, company environment, company facilities, company recommendations, and student competence after internship at the company.

The results of the study were obtained from 84 respondents who were apprentices who had been in 37 companies or agencies resulted in 4 stable clusters after 8 iterations. From the table of proximity to the center of the cluster can be seen that division of companies into 4 clusters can be an ideal division in choosing an internship place for students.

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