

ELECTRONIC DATA INTERCHANGE (EDI) APPLICATIONS USE THE DECISION TREE METHOD TO DETERMINE VENDOR RECOMMENDATIONS

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Abstract

Determination of vendor recommendations is one element of vendor performance evaluation of the procurement process. Lack of information and analysis obtained by PT. Cinovasi Rekaprima makes it difficult to predict vendor recommendations. Predicted vendor recommendations can help the Procurement Division in developing appropriate strategies to determine recommended vendors. This problem can be applied to data mining techniques to make predictions using the classification method. Decision Tree is a method that converts facts into decision trees that represent rules that can be interpreted by humans. Attributes that influence the determination of vendor recommendations consist of the availability of goods, services, ease of ordering and product quality. Sample data obtained directly from the Procurement Division of PT. Cinovasi Rekaprima is primary data in the form of vendor data (quotation) and secondary data in the form of vendor performance evaluation forms. The result of the EDI application is a classification consisting of 2 classes, namely recommended vendors and non-recommended vendors and the Procurement Division can use it for decision making to determine the right vendor, so that the procurement process becomes easier and increases company profitability. The testing model uses k-fold cross-validation with the k value is 1 to 10 fold. This application can determine vendor recommendations with the highest accuracy of 87.00 % on k-3 and k-5 fold.

Key words: Electronic Data Interchange (EDI), Decision Tree Method, Vendors, Procurement.

INTRODUCTION

The rapid development of technology in the fields of electronics, telecommunications, and information has accelerated the growth and economic development of both the business world in developing countries, especially the business world in developed countries. Some engineering technologies were developed to further facilitate data, information and financial transactions. Electronic Data Interchange (EDI) application is a technology model that combines aspects of electronics, telecommunications, and information, which was developed to facilitate the transaction process and exchange of information in e-procurement, especially for Business to Business (B2B) business models [1]. B2B which generally involves large business actors (corporations) needs the role of technology to facilitate each process that runs therein. This is because B2B generally involves a large business network and is unable to stand on its B2B business model is closely related to the supply and demand between corporations, which are usually described as supply chains [2]. The procurement of goods that is part of the B2B business model is also very dependent and pay attention to aspects of this supply chain to ensure the sustainability of their business. However, in Indonesia in particular, supply chain management in the field of procurement of goods has not been much helped by the development of information technology. For example, the use of EDI technology has not been maximized and effective incorporate business processes in general. The use of EDI in helping the long-term information system, the company's efforts to increase revenue must be supported by good company operational activities [3]. The application of the EDI application will help PT. Cinovasi Rekaprima in the process of procurement of goods by involving the vendor as a partner.

At PT. Cinovasi Rekaprima vendor data is not well managed and has not specifically addressed matters such as the criteria that must be met, so it cannot reduce errors that result in the procurement process being hampered. Therefore, vendor recommendations can help manage product procurement request data and be used as decision making and not cause harm to the company [6]. Sample data obtained directly from the Procurement

Division of PT. Cinovasi Rekaprima is primary data in the form of vendor data (quotation) and secondary data in the form of vendor performance appraisal. The data used are vendor data for the past 1 year, including vendor name and vendor performance evaluation. Determination of vendor recommendations is one element of vendor performance evaluation of the procurement process. Lack of information and analysis obtained by PT. Cinovasi Rekaprima makes it difficult to predict vendor recommendations. The importance of processing vendor performance appraisal that results in procurement cannot determine follow-up on the things needed to maintain the fulfillment of needs according to company criteria and the appropriateness of vendor performance to support the procurement activities in the company. Predicted vendor recommendations can help the Procurement Division in developing appropriate strategies to determine recommended vendors [7]. This problem can be applied to data mining techniques to make predictions using the decision tree method. The decision tree is a method that converts facts into decision trees that represent rules that can be interpreted by humans [8]. The class that results from this classification process is taken from the most classes produced by the decision trees in the decision tree method. Voting available decision trees increase the accuracy of the decision tree method. In selecting a vendor several attributes can influence the decision making. These attributes include service, availability of goods, product quality, ease of ordering products, and product information. Attributes that influence the determination of vendor recommendations consist of the availability of goods, services, ease of ordering and product quality [9]. The results of the EDI application using the decision tree method are a classification consisting of 2 classes, namely recommended vendors and non-recommended vendors and can be used for decision making for the Procurement Division to determine the right vendor, so that the procurement process becomes more effective, can minimize losses, and increase company profitability [10]. The testing model uses k-fold cross-validation with the k value is 1 to 10 fold. This application can determine vendor recommendations with the highest accuracy is 87.00% with k-3 and k-5 fold values.

MATERIAL AND METHODS

Research Methodology

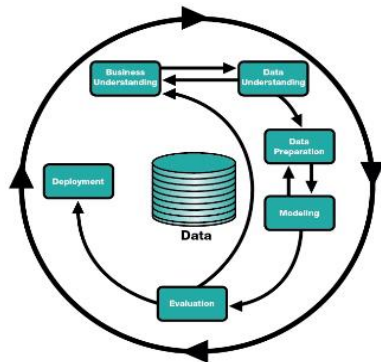


Fig 1. Cross Industry Standard Process for Data Mining

The phases in the Cross-Industry Process for Data Mining (CRIPS-DM) are as follows [11]:

1. Business Understanding

The first stage carried out in this study was a field survey, interview with PT. Cinovasi Rekaprima in the procurement division. Based on the results of interviews found that the process of procurement of goods at PT. Cinovasi Rekaprima begins with the client providing procurement request data to the project manager (pm), then the pm providing procurement request data to the procurement division to be made into a quotation to the selected vendor. If the vendor approves the offer letter, then the vendor will provide a purchase order to PT. Cinovasi Rekaprima. For vendor assessment itself, the company only evaluates vendors by manually filling out vendor assessment forms to assess vendor performance in the finished procurement process.

2. Data Understanding

At this stage, the data collected in this study is the procurement data in the procurement division, which is still in the form of vendor assessment forms. Data collection by recording activities that are ongoing in the vendor evaluation activities in the procurement division.

3. Data Preparation

The original data sample is a vendor assessment form obtained from observation before data preparation can be seen in the

attachment of vendor assessment form data. Based on the data obtained, the classification process will be processed. The final data used in the classification is the data of procurement requests from the client to the procurement party as follows:

Nama Vendor	KETERSEDIAAN	PELAYANAN	KUALITAS	KEMUDAHAN	INFORMASI	REKOMENDASI
Anametri Metrologi	Baik	Baik	Cukup Baik	Baik	Baik	Ya
Micro Komputer	Baik	Baik	Baik	Baik	Baik	Tidak
Foksel lectric Tbk	Cukup Baik	Cukup Baik	Baik	Cukup Baik	Baik	Tidak
Ultra Delta Maju	Cukup Baik	Baik	Cukup Baik	Cukup Baik	Cukup Baik	Tidak
Amgerra Berlian	Cukup Baik	Cukup Baik	Cukup Baik	Cukup Baik	Baik	Tidak
Global Perkasa	Baik	Cukup Baik	Cukup Baik	Baik	Baik	Ya
Andika Mitra	Cukup Baik	Cukup Baik	Baik	Cukup Baik	Baik	Ya
Nobi Angkasa	Cukup Baik	Cukup Baik	Baik	Baik	Cukup Baik	Ya
Sidola Komputer	Cukup Baik	Baik	Cukup Baik	Baik	Cukup Baik	Tidak

Fig 2. Figure vendor assessment data

4. Modeling

The design process model uses a unified model language and produces a use case diagram system that will be built is as follows:

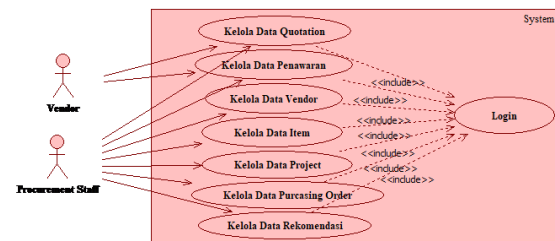


Fig 3. Figure vendor assessment data

5. Implementation

At this stage, the activity carried out is coding. For coding, researchers used the hypertext processor (PHP) programming language by using the Codeigniter framework and the Mysql database to build electronic data interchange (EDI) applications. In this stage, the decision tree method was also applied to the application to determine the recommended vendors.

6. Evaluation

In this stage validation and measurement of the accuracy of the results will be carried out and conclude from the results of the application of the decision tree method to determine the determination of vendor recommendations in the process of procurement of goods in the electronic data interchange (EDI) application based on implicit feedback and provide suggestions of the results obtained for subsequent researchers who will conduct research that has the same topic as this research.

7. Deployment

In this stage, the application of electronic data interchange (EDI) application will be carried out at PT. Cinovasi Rekaprima by using the decision tree method to determine vendor recommendations.

RESULT AND DISCUSSION

1. Decision Tree Method

Index Gini Formulation

To calculate the value of the Gini Index the following formula is used:

$$IG(A) = 1 - \sum_{k=1}^s p_k^2 \quad (1)$$

While the Split Gini value uses the following formula:

$$G_{split}(A) = p_1IG(p_1) + p_2IG(p_2) + \dots + p_kIG(p_k) \quad (2).$$

Calculates the Gini Index 4 Attributes

total		Jumlah	Ya	Tidak	IG	GINIsplit
		70	37	33		
pelayananan						0.2857
	by email	17	11	6	0.4567	
	by phone	34	26	8	0.3599	
	by surat	19	0	19	0.0000	
kemudahan						0.4970
	mudah	38	21	17	0.4945	
	cukup mudah	32	16	16	0.5000	
kualitas						0.4396
	sesuai	31	22	9	0.4121	
	cukup sesuai	12	6	6	0.5000	
	tidak sesuai	27	9	18	0.4444	
ketersediaan						0.2589
	tersedia	21	0	21	0.0000	
	tidak tersedia	49	37	12	0.3698	

Fig 4. Figure Calculates the Gini Index 4 Attributes

In selecting the attribute as root where the Gini split value from the Availability attribute is smaller, 0.2589, this attribute is selected as the root node (level 0). Next, to look for attributes at level 1 (under Availability) is to calculate the Gini index value of each remaining attribute under the Availability attribute.

Calculates the Gini Index 3 Attributes

In selecting the attribute as root where the Gini split value of the Service attribute is smaller that is 0.0392, then this attribute is selected as the second node (level 1). Next, look for attributes at level 2 by calculating the Gini index value of each remaining attribute under the Service attribute.

total		Jumlah	Ya	Tidak	IG	GINIsplit
		49	25	14		
pelayananan						0.0392
	by email	12	12	0	0.0000	
	by surat	11	0	11	0.0000	
	by phone	26	25	1	0.0740	
kemudahan						0.3686
	mudah	27	21	6	0.3457	
	cukup mudah	22	16	6	0.3967	
kualitas						0.3463
	sesuai	26	22	4	0.2604	
	cukup sesuai	8	6	2	0.3750	
	tidak sesuai	15	9	6	0.4800	

Fig 5. Figure Calculates the Gini Index 4 Attributes

Calculates the Gini Index 2 Attributes

total		Jumlah	Ya	Tidak	IG	GINIsplit
		26	24	2		
kemudahan						0.0710
	mudah	13	13	0	0.0000	
	cukup mudah	13	12	1	0.1420	
kualitas						0.0724
	sesuai	17	16	1	0.1107	
	cukup sesuai	5	5	0	0.0000	
	tidak sesuai	4	4	0	0.0000	

Fig 6. Figure Calculates the Gini Index 4 Attributes

In selecting the attribute as root where the Gini split value of the Ease attribute is smaller at 0.0710, this attribute is selected as the third node (level 2). Next, look for attributes at level 3 (under Ease) by calculating the Gini index value of each remaining attribute under Ease attribute

Calculates the Gini Index 1 Attributes

total		Jumlah	Ya	Tidak	IG	GINIsplit
		13	12	1		
kualitas						0.1410
	sesuai	12	11	1	0.1528	
	cukup sesuai	0	0	0	0.0000	
	tidak sesuai	1	1	0	0.0000	

Fig 7. Figure Calculates the Gini Index 4 Attributes

In selecting the attribute as root where the Gini split value of the Quality attribute is smaller that is 0.1410, then this attribute is selected as the fourth or final node (level 3). Next, to look for attributes at level 4 (under Quality) is to calculate the Gini index value of each remaining attribute under the Quality attribute.

The results of the decision tree based on the calculation of 70 training data using the Gini index formula and the Gini split decision tree method are as follows:

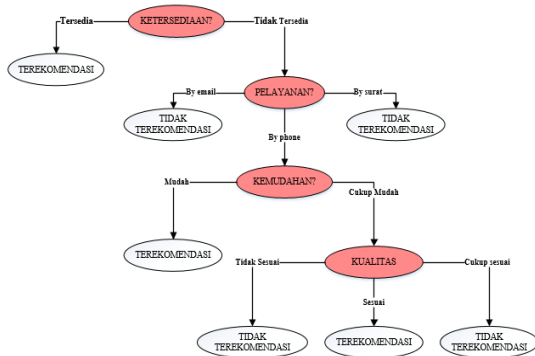


Fig 8. Figure Decision Tree

Two operators are usually used in rules, namely the AND conjunction operator and the OR disjunction operator. The formation of rules based on the decision tree is as follows:

1. R1: IF Availability = Available THEN Recommendations = Yes
2. R2: IF Availability = Not Available AND Service = By Email THEN Recommendation = No.
3. R3: IF Availability = Not Available AND Service = By Phone AND Convenience = Easy THEN Recommendations = Yes
4. R4: IF Availability = Not Available AND Service = By Letter THEN Recommendation = No.
5. R5: IF Availability = Not Available AND Service = By Phone AND Convenience = Quite Easy AND Quality = According to THEN Recommendation = Yes
6. R6: IF Availability = Not Available AND Service = By Phone AND Convenience = Quite Easy AND Quality = Not In Accordance THEN Recommendation = No
7. R7: IF Availability = Not Available AND Service = By Phone AND Convenience = Quite Easy AND Quality = Sufficient According to THEN Recommendation = No

2. K-Fold Cross-Validation

The method of testing with k-fold cross-validation with values k = 3, 5, 8 and 10. From the test results carried out, that at k = 3 and 5 is the optimal value of accuracy of 87% because the results of various extensive experiments and Theoretical proof, shows that 3 and 5 fold cross validation is the best choice to get accurate validation results 3 and 5 fold cross-validation ie repeat the test 3 and 5 times and the measurement results are the average values of 3 and 5 times the test.

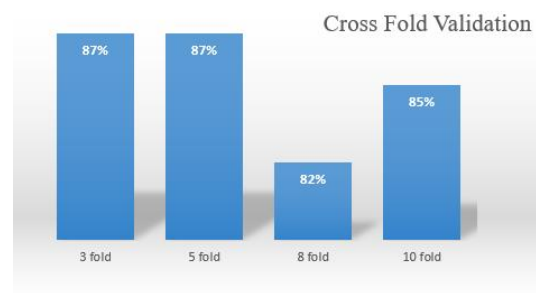


Figure 9. Figure K-Fold Cross-Validation

CONCLUSION

a. Conclusion Method

Decision tree method is a method that converts facts into decision trees that represent rules that can be interpreted by humans. The use of this method as a prediction feature of vendor recommendations uses (1) product availability, (2) service, (3) product quality and (4) ease of ordering with a predetermined value. The result of the decision tree method is a classification consisting of 2 classes, namely recommended vendors and non-recommended vendors and can be used for decision making for the Procurement Division to determine the right vendor, so that the procurement process becomes more and increases the company's profitability

b. Conclusion Problems

Based on research conducted by researchers with a background of problems regarding managing vendor performance appraisal to analyze the interrelation of vendor performance, as well as creating a procurement management system and adding predictions to vendor recommendations to assist the Procurement Division in the procurement process. Researchers found that this research can answer or provide solutions to existing problems. Using the method as a feature for predicting vendor recommendations will help the procurement party to have a picture of the use of vendor performance appraisal as the decision-maker to determine the vendor in the process of procurement of goods and determine the eligibility of vendors as partners. The recommended vendor data which is the result of predictions determines the continuation of cooperation with the vendor by PT. Cinovasi Rekaprima to further increase its sources of income.

c. Conclusion of Testing

After implementing the system using 100 sample data, it was concluded that the use of the decision tree method to predict vendor recommendations was successful by showing the highest accuracy were 87.00%. The method of testing with k-fold cross-validation with values $k = 3, 5, 8$ and 10 . From the test results carried out, that at $k = 3$ and 5 is the optimal value of accuracy of 87% because the

results of various extensive experiments and Theoretical proof, shows that 3 and 5 fold cross-validation is the best choice to get accurate validation results 3 and 5 fold cross validation ie repeat the test 3 and 5 times and the measurement results are the average values of 3 and 5 times the test. By evaluating vendor performance, it can determine vendor recommendations so companies can determine the right vendor for the procurement process

REFERENCES

- [1] G. Premkumar, K. Ramamurthy, and S. Nilakanta, "Implementation of electronic data interchange: an innovation diffusion perspective," *Journal of Management Information Systems*, vol. 11, no. 2, pp. 157–186, 1994..
- [2] P. Susetyorini, "Pelaksanaan sistem elektronik data interchange (edi) di pelabuhan tanjung emas sebagai alternatif prosedur kepabeanan," *Pandecta: Research Law Journal*, vol. 5, no. 2, 2010..
- [3] T. Mukhopadhyay, S. Kekre, and S. Kalathur, "Business value of information technology: a study of electronic data interchange," *MIS quarterly*, pp. 137–156, 1995.
- [4] S. Palaniswami and B. Lingaraj, "Procurement and vendor management in the global environment," *International Journal of Production Economics*, vol. 35, no. 1-3, pp. 171–176, 1994.
- [5] E. A. Purwanto, "e-procurement di indonesia pengembangan pelayanan pengadaan barang dan jasa pemerintah secara elektronik," 2007.
- [6] R. Angeles and R. Nath, "Business-to-business e-procurement: success factors and challenges to implementation," *Supply Chain Management: An International Journal*, vol. 12, no. 2, pp. 104–115, 2007..
- [7] M. Pal and P. M. Mather, "An assessment of the effectiveness of decision tree methods for land cover classification," *Remote sensing of environment*, vol. 86, no. 4, pp. 554–565, 2003.
- [8] R. Ariadni and I. Ariesianti, "Implementasi metode pohon keputusan untuk klasifikasi data dengan nilai fitur yang tidak pasti," 2015.
- [9] S. Vincenzi, M. Zucchetta, P. Franzoi, M. Pellizzato, F. Pranovi, G. A. De Leo, and P. Torricelli, "Application of a random forest algorithm to predict spatial distribution of the potential yield of ruditapes philippinarum in the venice lagoon, italy," *Ecological Modelling*, vol. 222, no. 8, pp. 1471–1478, 2011
- [10] G. Izmirlian, "Application of the random forest classification algorithm to a selditof proteomics study in the setting of a cancer prevention trial," *ANNALS-NEW YORK ACADEMY OF SCIENCES*, vol. 1020, pp. 154–174, 2004.
- [11] C. L. Iacovou, I. Benbasat, and A. S. Dexter, "Electronic data interchange and small organizations: Adoption and impact of technology," *MIS quarterly*, pp. 465–485, 1995.
- [12] A. S. Budiman, "Kajian penerapan edi dalam pengelolaan rantai pasokan di industri manufaktur," *Jurnal Ilmiah Teknologi Infomasi Terapan*, vol. 3, no. 3, 2017.