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A Study of Different Supplier Evaluation Techniques

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Abstract - *Supplier evaluation is a crucial aspect when it comes to supply chain mechanism. Supply Chain typically refers to a system of interconnected and dependent procedures and methods through which a raw material is molded into a finished product. Hence, supplier evaluation is the appropriate selection of supplier, and is an important condition for any organization to be able to manage its supply chain process effectively. There are multiple techniques used to achieve this purpose which include linear weighted models, fuzzy logic methods, mathematical models and total cost models. In this paper, we discuss three such techniques that include machine learning algorithms and data extraction from SAP tools, a linear weighted model in Analytic Hierarchy Process (AHP), followed by a TOPSIS algorithm approach to deal with supplier ranking, on the basis of attributes that include quality, quantity of products, delivery time, price and hence the deviation criteria. Different Enterprise Resource Products (ERP) systems have different attributes, however, we have decided on these based on the popularity and essentiality in terms of their usage in the industry and in the algorithms being discussed*

Key Words: **Analytic Hierarchy Process (AHP), ERP, Fuzzy clustering, Machine Learning, multi-criteria decision-making, SAP, SVM.**

1. INTRODUCTION

TODAY associations focus around center abilities and re-appropriate the non-center exercises. This has expanded the reliance of organizations on their providers and expanded the accentuation on provider base administration. Provider base administration rehearses are ordered into three classifications: supplier assessment, supply base defense, and provider advancement.

Supplier assessment incorporates all endeavors used by organizations in assessing their providers utilizing different provider choice models and strategies to help provider choice.

A few past kinds of research have demonstrated the utilization of measurable and numerical strategies for provider assessment. One ordinarily used strategy is the Data Envelopment Analysis (DEA) that can be utilized for the proposed model for provider streamlining, utilizing a cross breed approach including a blend of Gray Relational Analysis (GRA) and Analytical Hierarchy Process (AHP). Artificial Intelligence (ML) is utilized as an elective method that can be connected to determine complex classification issues. Support Vector Machine (SVM) is one significant ML calculation that is connected by immense number of specialists to determine classification issues. Notwithstanding, just a bunch of studies have been directed to date that have assessed the utilization of SVM to perform provider assessment. Most of independent ventures and expansive endeavors use data frameworks to deal with their acquiring capacities. Around 80 percent of fortune 1000 and 60 percent of fortune 2000 organizations use SAP as their ERP device [1] to oversee forms. SAP application can effectively oversee procedures and offer controls in capacities, for example, arranging of item, obtainment, stock administration, seller the executives, client benefits, etc[5]. SAP application can likewise deal with the obtainment procedure effectively from PROCURE to PAY.

2. HYPOTHESIS DISCUSSED AND RESEARCH PROBLEM

In this study, we will discuss about three different approaches, to solving the problem of Supplier Evaluation:

2.1 Research Problem

SAP application offers a provider assessment model structured on straight scoring model in which loads are physically allocated to the assessment criteria, for example, value, conveyance date, quality, etc. The supplier's assessment score is determined as whole of the weighted scores for each one of the assessment criteria. Hence, SAP and other ERP applications for the most part decide purchase particulars at a detail dimension of procurement request and consequently require performing execution estimations at each buy request detail level, that isn't normally structured in standard SAP provider assessment model. Hence, a manual method of evaluation of supplier efficiency is not possible on a detailed level. This makes it important to have automated processes and procedures that facilitate this process and provide more accurate analysis of the supplier performance.

2.2 Hypothesis Discussed

In the paper by Manu Kohli [1], the author discusses that, for business undertakings, provider assessment is a mission critical procedure. On ERP (Enterprise Resource Planning) applications, for example, SAP, the provider assessment process is performed by configuring a straight

score model, anyway this methodology has a constrained achievement. Consequently, author in this paper has proposed a two-arrange provider assessment model by incorporating information from SAP application and ML calculations. In the first step, the author has connected information extraction calculation on SAP application to assemble an information model. In the second stage, each occurrence in the information model is classified, on a position of 1 to 6, in view of the provider execution estimations, for example, on-schedule, on quality and as guaranteed amount highlights. From that point, the author has connected different AI calculations on preparing test with multi-classification goal to enable calculation to learn provider positioning classification. Empowering test results were seen when learning algorithms, (DT) and Support Vector Machine (SVM), were tried with in excess of 98 percent exactness on test informational indexes.

In the paper by E. Mehdizadeh and R. Tavakkoli Moghaddam [2], they discuss a fuzzy way to deal with arrangement with a bunching provider issue in a production network framework. Amid late years, deciding appropriate providers in the store network has turned into a key thought. Be that as it may, the nature of these choices is typically unpredictable and unstructured. By and large, numerous quantitative and subjective elements, for example, quality, cost, and adaptability and conveyance execution, must be considered to decide reasonable providers. The point of their investigation is to exhibit another methodology utilizing molecule swarm advancement (PSO) calculation for bunching providers under fluffy situations and ordering littler gatherings with comparative attributes. In the paper by Pema Wangchen Bhutia and Ruben Phipson [3], the authors describe to build up an approach to assess providers in store network cycle dependent on Technique for Order Preference by Similarity to Ideal Solution strategy (TOPSIS). The attributes they have used to make the supplier evaluation are, item quality, administration quality, conveyance time and cost. The author determines the attributes for every measure dependent on Analytic Hierarchy Process (AHP) and after that inputted these loads to the TOPSIS strategy to rank providers.

In this paper, we discuss the three most contemporary techniques of supplier evaluation: the first one that extracts data from SAP tools and uses SVM to classify suppliers [1]. Second is using Machine Learning Techniques, and a linear weighted model in Analytic Hierarchy Processing (AHP) [3], apart from a TOPSIS algorithm to classify supplier data.

3. SAP EXTRACTION ALGORITHM

The algorithm specified by Manu, for data extraction and transformation is described in Fig. 1. This flow chart involves instances, every single one of them has been taken from Purchase Order Header (EKKO), history table (EKBE and EKNET) or line item (EKPO) attributes. The primary key is Purchase Order.

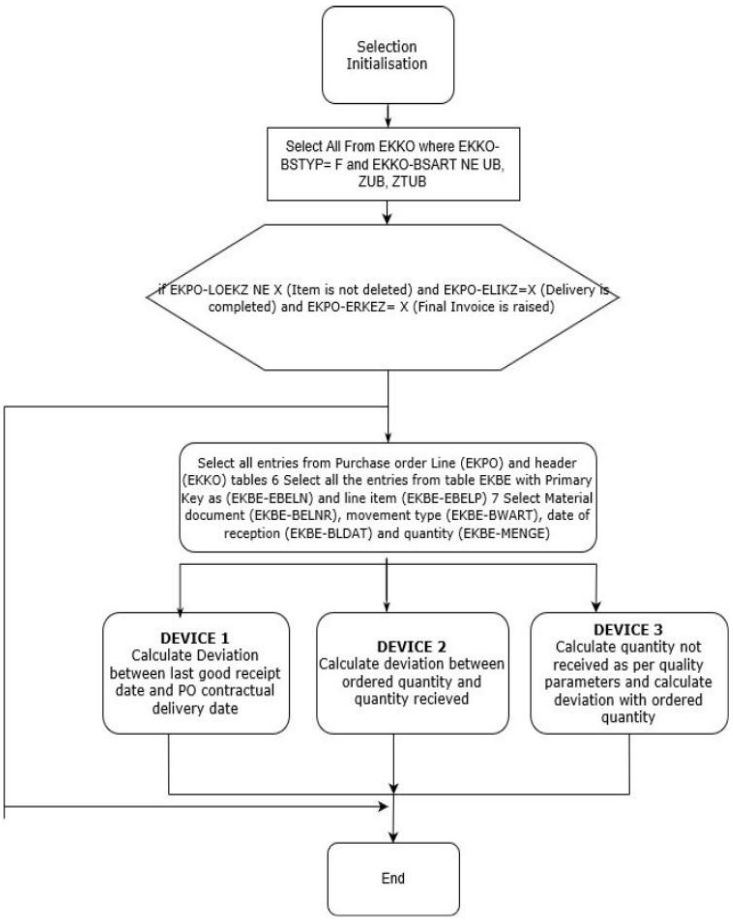

Fig -1: Flow Chart of Data extraction Algorithm [1]

4.IMPLEMENTATION OF MACHINE LEARNING ALGORITHMS

Different administered ML calculations are used, by utilizing 10-fold and 30 overlap cross-approval on the preparation informational index [1]. Application of Machine learning Algorithms on Dataset According to Salzburg [6], cross-approval is a successful strategy to decrease information reliance and improve the dependability of the classifier results. Every ML calculation amid preparing was exposed to 10 and 30 overlap cross-approval to guarantee speculation and stay away from over-fitting.

The outcomes recorded are documented in Table 1 [1], for the test sets specifying exactness, accuracy, review, genuine positive rate (TPR) and F-score for every calculation. The surveyed outcomes demonstrated that Decision tree, SVM, and LR classified both preparing and test informational collections with exactness rate of in excess of 96 percent. On study of the outcomes, it may be securely presumed that LR, SVM, and Decision tree are reasonable for performing provider classification.

Table -1: Results comparison by using different ML algorithms [1]

Algorithm	Accuracy	Precision	Recall	F-measure	TPR
NB (CV 10 Fold)	90.8512	0.914	0.909	0.908	0.909
NB (CV 30 Fold)	90.967	0.915	0.91	0.909	0.91
DT (CV 10 Fold)	98.0892	0.981	0.981	0.981	0.981
DT (CV 30 Fold)	98.08	0.981	0.981	0.981	0.981
KNN (CV 10 Fold)- K=1	94.03	0.941	0.94	0.94	0.94
KNN (CV 10 Fold)- K=20	91.6	0.913	0.916	0.914	0.916
SVM (CV 10 Fold)	97.85	0.979	0.979	0.979	0.979
SVM (CV 30 Fold)	97.85	0.979	0.979	0.979	0.979
LR (CV 10 Fold)	95.13	0.951	0.952	0.952	0.964
LR (CV 30 Fold)	96.29	0.963	0.962	0.962	0.963

5. ANALYTIC HIERARCHY PROCESS (AHP)

The AHP [2], takes into account a lot of assessment criteria, and a lot of elective alternatives among which the best choice is to be made. It is essential to take note of that, since a portion of the criteria could be differentiating, it isn't valid that the best choice is the one which improves each single basis, rather the one which accomplishes the most appropriate exchange off among the various criteria.

The AHP creates a weight for every assessment paradigm as per the leader's pairwise examinations of the criteria. The higher the weight, the more significant the comparing foundation. Next, for a fixed paradigm, the AHP allots a score to every alternative as indicated by the leader's pairwise correlations of the choices dependent on that model. The higher the score, the better the execution of the alternative concerning the thought about measure. At long last, the AHP consolidates the criteria loads and the alternative scores, in this way deciding a worldwide score for every choice, and a resulting positioning. The worldwide score for a given alternative is a weighted total of the scores it acquired as for every one of the criteria.

The Analytic Hierarchy Process, as shown in Fig. 2, is a strategy intended to evaluate administrative decisions of the general significance of every one of a few clashing criteria utilized in the basic leadership process. AHP cab be utilized with the accompanying strides to assist with measuring the relative significance or the weighted estimations of a few criteria.

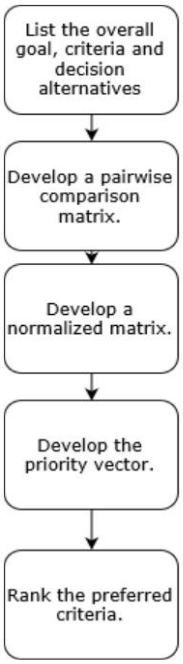

Fig -2: Flow Chart of AHP procedure[2]

6. TOPSIS ALGORITHM

TOPSIS is a basic leadership method. It is an objective based methodology for finding the elective that is nearest to the perfect arrangement.

In this strategy, choices are evaluated based on perfect arrangement comparability. On the off chance that an alternative is progressively like a perfect arrangement, it has a higher evaluation. Perfect arrangement is an answer that is the best from any perspective that does not exist for all intents and purposes and we attempt to surmise it. Essentially, for estimating likeness of a structure (or choice) to perfect dimension and non-perfect, we think about separation of that plan from perfect and non-perfect arrangement.

In view of Analytic Hierarchy Process (AHP the loads for every standard have been determined and inputted those loads to the TOPSIS technique to rank providers. The primary favorable circumstances of utilizing TOPSIS technique are: -

1. It is easy to utilize.
2. It considers a wide range of criteria (abstract and goal).
3. It is judicious and reasonable.
4. The calculation forms are straight forward.
5. The idea allows the quest for best options model portrayed in a straightforward scientific figuring.

General TOPSIS process with 7 stages is recorded in the steps, as shown in Fig. 3.

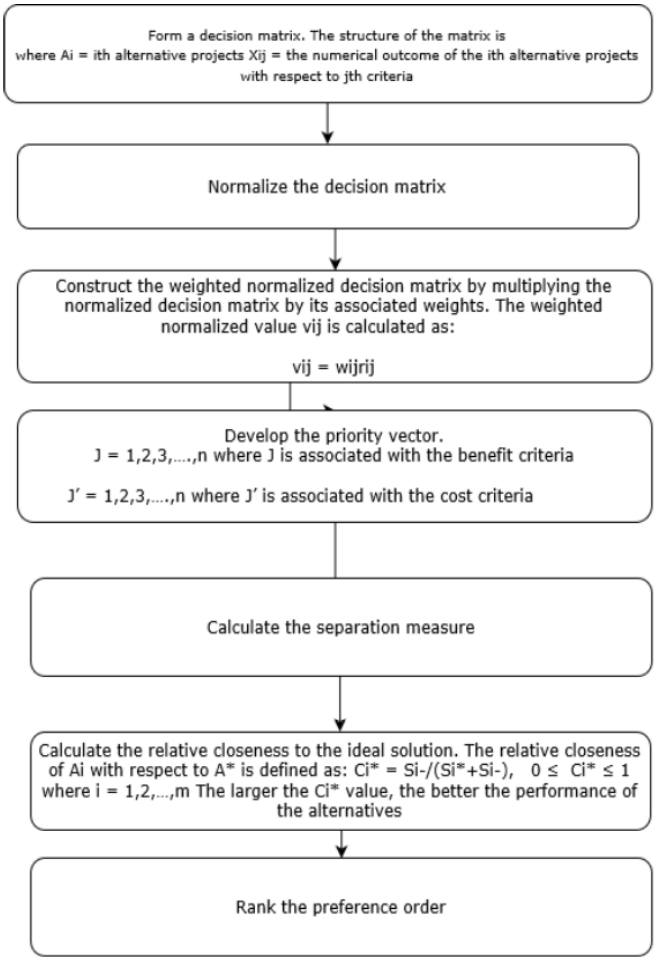

Fig -3: Flow Chart of TOPSIS algorithm[2]

7. CONCLUSION

The provider exhibition assessment model utilizing provider recorded execution estimation information taken from the SAP application, has been discussed. The classifier model was prepared on preparing test informational index and was hence tried on the test informational index. The test outcomes demonstrated that DT and SVM calculations had the capacity to effectively perform provider positioning classification, with group technique or something else, with in excess of 98 percent exactness. The examination focal point of the present paper is to perform provider assessment utilizing chronicled information accessible in the data framework [4], anyway it is prescribed to complete further research to perform provider assessment utilizing AI procedure dependent on survey of the providers accessible via web-based networking media also.

In supply chains, co-appointment between a producer and providers is normally a troublesome and significant connection in the channel of dissemination. This paper shows a multi-criteria basic leadership for assessment of provider by actualizing TOPSIS technique. This strategy is easy to comprehend and allows the quest for best choices rule delineated in a straightforward scientific figuring. Because of this, basic leadership for determination of reasonable provider is of unique significance.

REFERENCES

[1] [1] Manu Kohli, "Supplier Evaluation Model on SAP ERP Application using Machine Learning Algorithms", Indiana University Bloomington, USA, July 2017, pp.1-6.

[2] [2] E. Mehdizadeh and R. Tavakkoli-Moghaddam, "A hybrid fuzzy clustering PSO algorithm for a clustering supplier problem," 2007 IEEE International Conference on Industrial Engineering and Engineering Management, Singapore, 2007, pp. 1466-1470.

[3] [3] Pema Wangchen Bhutia, Ruben Phipon, "Application of ahp and TOPSIS method for supplier selection problem", IOSR Journal of Engineering (IOSRJEN), October 2012, vol. 2, no. 10, pp. 43-50.

[4] [4] M. SandT. ERP Share by Fortune 2000 companies, year = 2017, url = http://erp.mst.edu, urldate = 2017-02-02.

[5] [5] S. R. Magal and J. Word, "Integrated business processes with ERP systems", Wiley Publishing, 2011.

[6] [6] S. L. Salzberg, "On comparing classifiers: Pitfalls to avoid and a recommended approach", Data mining and knowledge discovery, vol. 1, no. 3, pp. 317–328, 1997.

[7] [7] F. Faerber, J. Dees, M. Weidner, S. Baeuerle and W. Lehner, "Towards a web-scale data management ecosystem demonstrated by SAP HANA," 2015 IEEE 31st International Conference on Data Engineering, Seoul, 2015, pp. 1259-1267.

[8] [8] S. Bracher, Mark Holmes, Liam Mischewski, Asadul Islam, Michael McClenaghan, "Advanced analytics on SAP HANA: Churn risk scoring using call network analysis," 2015 IEEE 31st International Conference on Data Engineering, Seoul, 2015, pp. 1400-1403.

[9] [9] J. Lee, Young Sik Kwon, Franz Farber, "SAP HANA distributed in-memory database system: Transaction, session, and metadata management," 2013 IEEE 29th International Conference on Data Engineering (ICDE), Brisbane, QLD, 2013, pp. 1165-1173.

[10] [10] Berdie, A.D., Osaci, M., Prostean, G., Cristea, A.D "Web Programming features on integrated system SAP", 6th IEEE International Symposium on Applied

Computational Intelligence and Informatics (SACI), Timisoara, Romania, pp. 227–230, 2011.

[11] [11] Bansal, V Argarwal, A. "Enterprise resource planning: identifying relationships among critical success factors", Business Process Management Journal, 2015, vol. 21, no. 6, 1337-1352.

[12] [12] Doom, C Milis K, P. S. & B. E. "Critical success factors for ERP implementations in Belgian SMEs", Journal of Enterprise Information Management, 2011, vol. 23, no. 3, 378 – 406.

[13] [13] Aliyu Usman Shehu, Tariro Masunda. "The review of critical success factors of enterprise resource planning system implementation." Discovery, 2018, vol. 54, no. 276, 484-495

[14] [14] B. Kocaoglu and A. Z. Acar, "Process development in customer order information systems to gain competitive advantage: a SME case study," International Journal of Logistics Systems and Management, vol. 23, no. 2, pp. 209–230, 2016.

[15] [15] Sachin Patel, Vipul Shah, "Automated testing of software-as-a-service configurations using a variability language", Proceedings of the 19th International Conference on Software Product Line, pp. 253, 2015.