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Article DOI: 10.21474/IJAR01/xxx

DOI URL: http://dx.doi.org/10.21474/IJAR01/xxx

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MEASUREMENT OF SUPPLY CHAIN SUPPLY CHAIN PERFORMANCE USING DATA ENVELOPMENT ANALYSIS (DEA) METHOD IN BOGOR PROVINCE.

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MEASUREMENT OF SUPPLY CHAIN PERFORMANCE USING DATA ENVELOPMENT ANALYSIS (DEA) METHOD IN THE DISTRICT AND CITY OF BOGOR

Abstract:

This study aims to measure the   performance of the internal supply chain in Small and Medium Enterprises (SMEs) of footwear industry with the Data Envelopment Analysis (DEA) approach. The object of research in SMEs used six inputs and three outputs as indicators of supply chain performance. The inputs used were order fulfillment time, order fulfillment cycle, supply chain flexibility, total supply chain costs, cash to cash cycle time, and daily inventory. The output used, were delivery performance, order fulfillment and compliance with standards. This research had 21 Decision Making Units (DMU). The efficiency results obtained from the twenty-first was the average efficiency value of 0.721. There were five SMEs that already have an efficiency value of 1 which showed the highest efficiency, namely SMEs numbers 11, 14, 15 17 and 19. Those SMEs that had the highest efficiency have advantages compared to other SMEs, such as having inventory, chain costs low supply and fairly short footwear production cycle.

Introduction:-

Indonesia's footwear is an important component of the country's economy which is able to contribute 3.1% of total merchandise exports. The value of Indonesia's footwear exports in 2016 reached 4.6 billion US dollars, ranking sixth largest in the world. The average growth of footwear exports has been 11.2% in the past decade (The Conference Board of Canada, 2018). Indonesia's footwear industry has the advantage of being able to absorb a lot of labor so that it will reduce the unemployment rate in Indonesia. The weakness of the Indonesian footwear industry is the high level of dependence on imports of raw materials, supporting materials and components especially for export destination products due to the limited ability of the domestic supplier industry, in addition to the large number of imported footwear products on the market at low prices distorting the national footwear industry market. The still limited ability of human resources in mastering production and design technology is also one of the weaknesses, so it is slow in anticipating the development of market needs (Yunika, 2017).

Measurement of supply chain performance as a whole involves all components of the supply chain members from suppliers to consumers. The existing supply chain performance measurement model applied in the field refers to supply chain activities within an organization that generally cover procurement activities, production planning, production, fulfillment of customer orders and returns (Pujawan 2005). Traditional performance measures such as through profits are no longer used, because profit measures tend to lead to the performance of individual members of the supply chain. The most integrated performance measures that best describe the performance of the supply chain.

Footwear is made in two business scales, namely Small and Medium Enterprises (SMEs). There are industries that produce their own footwear and there are also those who work with SMEs or craftsmen in producing footwear. Industries that work closely with artisans in producing footwear will provide the materials needed to produce footwear. The most significant difference from industry and craftsmen is the use of machines in producing footwear, so that footwear products produced by the industry have better durability. In addition, the materials used by industry also have better quality compared to craftsmen who will affect the selling price of the resulting footwear products. The raw materials used by the footwear business, both craftsmen and industrie, come from domestic and foreign countries. For craftsmen, the materials used are obtained from shops around the production location or can also be obtained from factories in the Bekasi or Tangerang area. There are two locations to buy footwear produced, namely in shopping centers and footwear sales shops. Seller stores have fewer products and types of products than shopping centers. In addition, footwear sold in shopping centers are of better quality than products sold by footwear shops. The quality of footwear sold will affect the price of the product, so the price of footwear in a shopping center is more expensive when compared to footwear shops.

In general, SMEs craftsmen have full dependence on the giver of orders relating to aspects of capital, procurement of raw materials and marketing. While independent SMEs that have their own capital do not depend on the giver of the order. The skill of making footwear that most of the craftsmen have is obtained from generation to generation and from their experience, who had previously worked as laborers in footwear workshops so that they were very skilled in the techniques in making footwear.

Methods:-
The DEA model was built to measure supply chain efficiency with six inputs and three outputs. The selection of locations is done at the center of footwear SMEs in district and city of Bogor with the consideration that it is one of the centers of the footwear industry and has exported to several countries. Data collection in this study was carried out in January-August 2019.
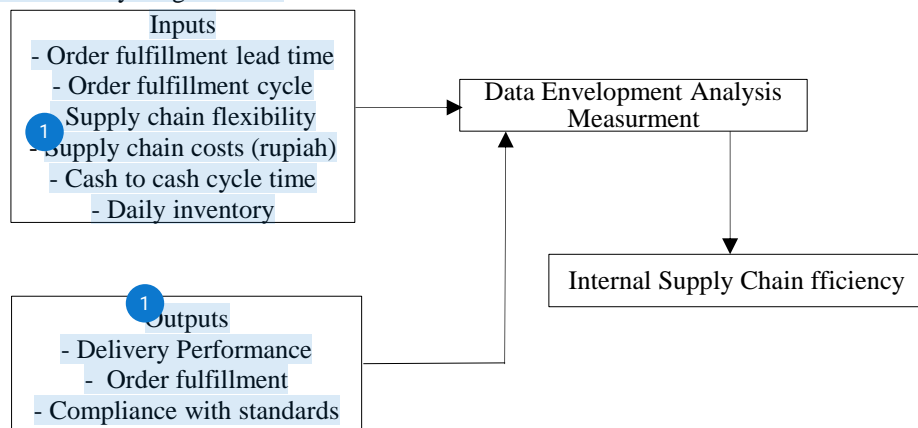

Figure 1. A conceptual model for measuring internal supply chain

Basic DEA and Model Contraception
DEA measures the level of inefficiency by comparing the results of the achievement of the DMU against the efficient value formed by the DMU with an inefficient value. Each decision-making unit is assumed to be free to determine the weights to determine the output or input variables. DEA can measure several inputs and outputs, as well as evaluate quantitatively and qualitatively, thus enabling a company to make good decisions on the level of efficiency of the unit being analyzed (Homepage DEA 2007). Data processing by DEA method is done using Win4Deap2 software. The result of processing with this method is a performance matrix that has the potential to be improved (Maharani et al 2014).

The fraction form of the DEA mathematical programming model is as follows:

$$maximize\ h0 = \frac{\sum_{r=1}^{t} Ur\ Yrj0}{\sum_{i=1}^{m} Vr\ Xij0}$$

Subject to :

$$\frac{\sum_{r=1}^{t} Ur\ Yrj}{\sum_{i=1}^{m} Vr\ Xij} \leq 1, \quad j = 1,\ldots, n$$

$Ur \leq \varepsilon$ $r = 1,\ldots, t$ $Vi \leq \varepsilon,$ $i = 1,\ldots., m$

where, Ur is the weight for output r; Vi is the weight for input i; Yrj is the number of outputs DMU j; Xij is input I from DMU j; t is the amount of output; m is the number of inputs; n is the number of DMU; and 1 is a small positive number.

The study sample was taken using purposive sampling technique, which uses one method of non-probability sampling (non-random or intentional sampling). Criteria for respondents to be examined are respondents who have knowledge and / or have experience about the footwear industry. The selected respondents represent companies or SMEs that are considered to have a deep understanding of the supply chain and the overall condition of the company. By brainstorming actors in SMEs, input and output variables are obtained that are used based on the SCOR indicator.

Variable Input;

(1) Lead time fulfillment is the time required by the industry to meet the needs of consumers expressed in units of days.

(2) The order fulfillment cycle is the time required by the industry in one order cycle, expressed in units of days.

(3) Supply chain flexibility is the time required to respond to the supply chain if there are unexpected orders either increasing or decreasing orders without being subject to penalty fees, expressed in units of days.

(4) The total cost of supply chain management is the total cost incurred by the industry in handling materials from suppliers to consumers, expressed in rupiah units.

(5) Cash to cash cycle time is the velocity of industrial money from the payment of raw materials to suppliers, to the payment or repayment of products by consumers, which are stated in units of days.

(6) Daily supply is the length of the supply that is sufficient to meet the needs if there is no further supply, which is stated in units of days.

Variable Output;

(1) Delivery performance is the percentage of order delivery on time that is in accordance with the date of the customer's order and or the date that the customer wants, expressed in percent (%).

(2) Fulfillment of orders is a percentage of the number of consumer requests that can be fulfilled without waiting, expressed in percent (%).

(3) Standard conformance is the percentage of the number of consumer requests sent in accordance with the standard determined by the consumer, expressed in percent.

Result and Discussion:-

The performance measurement model for footwear SMEs is built based on consideration of internal supply chain performance, namely the performance of SMEs in district and city of Bogor. Variables or indicators used in measuring the performance of footwear supply chains are based on the SCOR (Supply Chain Operation Refference) working matrix, where SCOR includes reliability, responsiveness, flexibility, cost and assets (Marimin and Maghfiroh 2010). In Wong and Wong 2007, explained, level 1 consists of top-level metrics that cover four basic processes - plan, source, create, send, and expand in all parts of the manufacturing and shipping process. Level 2 consists of process categories and serves as a platform for companies to implement operations strategies. Level 3 covers the level of process elements and defines the company's ability to compete successfully in selected markets. This is also the level at which companies refine their operations strategy. Finally, level 4 is the implementation level, where certain supply chain management practices to adapt to changing business conditions are defined. DEA is used as a tool to analyze these variables with the aim of evaluating the efficiency of internal supply chains in footwear SMEs in district and city of Bogor.

Footwear SMEs work within a period of one week to fulfill any number of orders by increasing or reducing the workers they have. Workers at footwear SMEs usually do not have a fixed work association and are paid based on the amount of footwear produced or a piece system. Footwear SMEs also work based on orders given, so they do not have daily inventory and cannot fulfill unexpected orders, except for 4 SMEs that have inventory. SMEs that have daily supplies are collectors who receive footwear from several workshops that work together. The availability of supplies will affect the flexibility of the supply chain owned. The more inventory, the supply chain flexibility or sudden order fulfillment more and more fulfilled. Supply chain costs are costs incurred to

distribute the products produced. SMEs distributes its goods depending on the distance traveled. For marketing products that are still in the Bogor area, a motorcycle can carry 60 pairs of footwear. SMEs that have further marketing areas, usually use cars. For SMEs that do not have supply chain costs, it shows that the products produced are taken directly by consumers to the production site. Each SMEs also has a different cash to cash time depending on the consumer being served because it has a different payment system.

Table 1. List of Input Values for Measuring the Performance of Footwear SME Supply Chains

DMU	Order fulfillment lead time (days)	Order fulfillment cycle (days)	Supply chain flexibility (days)	Supply chain costs (Rp)	Cash to cash cycle time (days)	Daily inventory (days)
1	7	7	7	3,196	30	0
2	7	7	7	1,614	60	0
3	7	7	7	2,160	7	0
4	7	7	2	2,786	30	2
5	7	7	7	3,276	30	0
6	7	7	7	3,196	30	0
7	7	7	7	1,756	7	0
8	7	7	7	3,487	60	0
9	7	7	7	1,545	7	0
10	7	7	7	1,657	7	0
11	7	7	4	1,598	7	4
12	7	7	7	1,678	7	0
13	7	7	7	1,254	7	0
14	7	7	3	1,743	7	3
15	1	1	1	2,734	1	1
16	7	7	7	1,716	7	0
17	7	7	7	0	7	0
18	7	7	7	854	7	0
19	7	7	7	0	7	0
20	7	7	7	1,695	7	0
21	7	7	7	3,341	40	0

The output measured in this study consists of delivery performance, order fulfillment and compliance with standards seen using percent units. Shipping performance shows how SMEs meet all requests. All SMEs have a shipping performance of 100% which shows that all SMEs can meet consumer demand in a timely manner according to the footwear production cycle, which is 7 days. The resulting product also has a standard conformity with consumer desires, which is indicated by the amount of footwear returned. The less footwear that is returned means conformance to standards and greater consumer desires. Order fulfillment is affected by the amount of inventory, because it is an order fulfillment when an additional order is given without the need to produce. Most footwear SMEs do not have inventory due to limited capital and product storage.

Table 2. The SME Footwear Output Value

DMU	Delivery Performance (%)	Order fulfillment (%)	Compliance with standards (%)
1	100	0	80
2	100	0	95
3	100	0	80
4	100	30	95
5	100	0	90
6	100	0	80
7	100	0	90
8	100	0	95
9	100	0	90
10	100	0	95
11	100	0	85
12	100	50	95
13	100	0	100
14	100	40	95

DMU	Delivery Performance (%)	Order fulfillment (%)	Compliance with standards (%)
15	100	10	100
16	100	0	95
17	100	0	95
18	100	0	90
19	100	0	90
20	100	0	85
21	100	0	100

The results of the calculation of supply chain performance efficiency using software obtained an average efficiency value of 0.764. There are 6 SMEs that already have an efficiency value of 1 which shows the highest efficiency, namely SMEs number 1, 6, 11, 14, 15 and 17. That is because, all SMEs that have the highest efficiency have advantages compared to other SMEs, such as having inventory , low supply chain costs and fairly short cash to cash cycle time. In addition, these SMEs also have a fairly good output value. SMEs with the lowest efficiency values, namely SMEs numbers 5, 8 and 21. This happens because, SMEs with the lowest efficiency have the highest supply chain costs with the longest cash to cash cycle time and do not have inventory. Cash to cash cycle time shows the time needed to receive payments from consumers. SMEs with the lowest efficiency are paid by consumers in more than 30 days, while other SMEs are mostly paid within 7 days.

Conclusion:-

This study measure the efficiency of supply performance in small and medium footwear industries in the district and city of Bogor. There are still many of the DMUs that are measured as inefficient, due to high supply chain costs, the long cash to cash cycle time and lack of inventory. The contribution of this research is expected to provide useful insights in the use of DEA as a tool in measuring supply chain efficiency.

References:-

1. Amirteimoori, A., & Khoshandam, L. (2011). A Data Envelopment Analysis Approach To Supply Chain Efficiency, *2011*. Https://Doi.Org/10.1155/2011/608324.
2. Bai, C., & Sarkis, J. (2014). Determining and applying sustainable supplier key performance indicators. Supply Chain Management, 19(3), 275–291. https://doi.org/10.1108/SCM-12-2013-0441.
3. Charnes, A. (1978). Measuring The Efficiency Of Decision Making Units, *2*, 429–444.
4. Cox, A. (N.D.). Power , Value And Supply Chain Management, (4), 167–175.
5. Dev, N. K., Shankar, R., & Debnath, R. M. (2014). Supply Chain Efficiency: A Simulation Cum DEA Approach. *International Journal Of Advanced Manufacturing Technology*. Https://Doi.Org/10.1007/S00170-014-5779-6
6. Herminiwati, H., & Lestari, S. B. P. (2016). The Effect of Added Aluminum Silicate and Azodicarbonamide On Production Of Microcellular Rubber For Light Sole. Leather, Rubber and Plastic Magazine. Https://Doi.Org/10.20543/Mkkp.V25i1.230.
7. Khezrimotlagh, D. (2014). How to deal with numbers of decision making units and variables in data envelopment analysis, (1989), 1–11.
8. Liang, L., Yang, F., Cook, W. D., & Zhu, J. (2006). DEA Models For Supply Chain Efficiency Evaluation, (July), 35–49. Https://Doi.Org/10.1007/S10479-006-0026-7.
9. Marimin, Maghfiroh N. 2010. Application of Decision Making Techniques in Supply Chain Management. IPB Press, Bogor.
10. Nurzamzami, Ayatusyifa; Siregar, E. H. (2014). Increased Competitiveness of Footwear MSMEs in Ciomas District, Bogor Regency and Their Implications for Marketing Strategies. *Journal of Management and Organization Vol V, No 1*, *85*(1), 129–133. Https://Doi.org/10.29244/jmo.v5i1.12127
11. Pujawan IN. 2005. Supply Chain Management. Surabaya: Publisher Guna Widya.
12. Warsito and Suparno. (2008). Supply Chain Efficiency Evaluation with Data Envelopment Analysis (Dea) Model (Case Study in Pt Paramithatama Asriraya). Proceedings of the National Seminar on Technology Management VIII. MMT-ITS Study Program, Surabaya 2 August 2008.
13. Thanh Phan, X. T., Pham, C. H., & Pham, L. (2016). The Competitive Advantages Of Vietnam Footwear Industry: An Analysis. *International Journal Of Financial Research*, *7*(3), 65–80. Https://Doi.Org/10.5430/Ijfr.V7n3p65.
14. Tajbakhsh, A., & Hassini, E. (2015). A data envelopment analysis approach to evaluate sustainability in supply chain networks. Journal of Cleaner Production, 105, 74–85. https://doi.org/10.1016/j.jclepro.2014.07.054.
15. The Conference Board Of Canada. (2018). An Analysis Of The Global Value Chain For Indonesian Coffee Exports. *The Canada–Indonesia Trade And Private Sector Assistance (TPSA) Project*, (February).
16. Wong, W. P., & Wong, K. Y. (2007). Supply chain performance measurement system using DEA

modeling. Industrial Management and Data Systems, 107(3), 361–381. https://doi.org/10.1108/02635570710734271

17. Wong, W. P. (2008). A review on benchmarking of supply chain performance measures, 15(1), 25–51. https://doi.org/10.1108/14635770810854335

18. Yunika. (2017). Competitiveness Of Export Footwear Industry Between Indonesia And China In The United States Market In 2011-2014. *JOM FISIP Vol. 4 No. 2*, *4*(2), 1–16.

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