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Analysis of Digital Supply Chain Management in E-procurement Service Usage Using Decision Making Trial Method and Evaluation Laboratory in National Public Procurement Agency

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Abstract.
This study aimed to identify the implementation of the digital supply chain and its priority in the National Public Procurement Agency's e-procurement service. To this end, a quantitative study with Decision-Making Trial and Evaluation Laboratory (DEMATEL) method using Matlab R2105a. DEMATEL result showed that eight criteria in the dispatcher group became the main priority in DSCM implementation in LKPP's e-procurement process. In comparison, the other eight criteria in the receiver group serve as the advanced criteria in DSCM implementation. The planning criterion was the most prioritized and the most influential DSCM criterion in LKPP's e-procurement service, which covers the distribution requirement process. The three most important DSCM criteria in LKPP's e-procurement service were the distribution requirement process, delivery and inspection, and transportation management. The analysis showed that some DSCM criteria in LKPP's e-procurement had met the DSCM principle. Further studies using other methods like Analytic Hierarchy Process (AHP) and Analytical Network Process (ANP) are needed.

Keywords: E-procurement, LKPP, Digital supply chain management, DEMATEL.
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INTRODUCTION

The electronic procurement (e-procurement) system is one of the efforts made by the Indonesian government to improve the efficiency, effectiveness, transparency, and accountability of the annual state budgeting. It is designed by the Directorate of E-Procurement System Development and National Public Procurement Agency (LKPP), in collaboration with National Cyber and Crypto Agency for document encryption system and Finance and Development Supervisory Agency (BPKP) for the audit subsystem. Called Sistem Pengadaan Secara Elektronik (SPSE), this system is developed and operated by Electronic Procurement Service (LPSE) [1][2].

E-procurement activities are not limited to the procurement process. It covers the integration of procurement plan, process, receipt and storage, asset use and management, and transactions (i.e., goods/service purchasing (contract), goods/service received, and goods/service use). These integrated activities allow LKPP's e-procurement system to play central roles in improving governmental institutions' performance and facilitating goods/service providers to expand their business opportunities [3], [4].

Taking basic principles of e-procurement (i.e., efficiency, effectiveness, accountability, transparency, fairness, non-discriminating, fair and open competition, interoperability, and data security warranties) into account, the development of e-procurement is inseparable from Supply Chain Management (SCM) because e-procurement and SCM share the same goal, i.e., improving operational efficiency [5]. In this industry 4.0 era, SCM has shifted to digital supply chain management (DSCM) [6]. In this study, LKPP was selected as the observation object related to the e-procurement system that previously applied SCM and moved to DSCM.

This system change is caused by a number of factors, including the need to improve time, material, and human resource efficiency. The manual procurement process is considered time-consuming, where it

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usually takes about 43 days for the pre-qualification selection process and 20 days for the post-qualification selection. The old system also lacks provider selection monitoring by the Goods/service procurement working unit (UKPBJ), complicating the supervision of distribution tasks by the heads of the UKPBJ and Inspectorate. Other issues arise from the lack of follow-up of the analysis result, in addition to poor information integration and performance monitoring in each supply chain of SPSE.

Regarding these issues faced by LKPP during its transition phase, it should be noted that DSCM implementation needs to consider four components: digital planning, digital supply, digital manufacture, and digital logistics [7]. By addressing these components, LKPP's e-procurement system will likely exhibit a significant improvement. The old SCM cycle has limited visibility, lacks real-time data updates, and has poor responsiveness.

There are several methods that can be used to measure and identify supply chain management relationships/influences [8], [9], the Decision-Making Path and Evaluation Laboratory (DEMATEL) method is used to investigate obstacles in Green Supply Chain Management (GSCM) in Canadian manufacturing companies[10]. In addition, DEMATEL is also applied [11] the DEMATEL method is used to identify dimensions and critical factors important factors in the implementation of green supply chain management (GSCM). Then build a digraph to show the causal relationship between the dimensions and factors of each dimension in GSCM. This study has different from previous studies where the focus in this study is the analysis of the priority implementation of DSCM on the performance of e-procurement services.

Therefore, DSCM implementation analysis is expected to provide a positive change in e-procurement. Due to its limited resources, LKPP needs more time and energy to develop and implement e-procurement by applying a digital supply chain to all stakeholders of SPSE. In this regard, analyzing the priority in digital supply chain implementation is necessary to allow more focused system development.

This study attempted to analyze the DSCM in LKPP's e-procurement system using Decision-Making Path and Evaluation Laboratory (DEMATEL). DEMATEL was used to find out the relationship or effects among DSCM in order to picture a concept of procurement ecosystem so that the decision-making process of each party in every supply chain could be better linked, controlled, measured, more flexible, on time, and cost-effective [12]–[14]. The result of this study is expected to provide LKPP's e-procurement development team with a guideline that presents a list of important points the development should focus on. Such a guideline would be helpful for the system developers in minimizing uncertainty and addressing potential hindrances when following the e-government policy direction and industry 4.0 era.

METHODS

Materials

This study was categorized as mixed-method research involving both quantitative and qualitative approaches. The quantitative approach in this study applied the purposive sampling technique by determining a set of criteria to recruit the respondents [15], [16]. The purposive sampling technique was chosen because it is helpful to obtain respondents' characteristics that are more relevant to the research context. The study population was IT Operation and IT Development staff in the Directorate of Electronic Procurement System Development, National Public Procurement Agency (LKPP), who have an adequate understanding of e-procurement and have worked for at least two years (25-50 years of age). Meanwhile, the qualitative data in this study were collected through interviews and observation. The research object was the LKPP's E-procurement use. The observation and data collection results were analyzed for its DSCM using DEMATEL with MatLab R2015a.

Stage of Research

Figure 1 presents the research stages. First, we identified the problem or phenomenon to examine as the research problem, which has been described in the introduction section above. In this stage, DSCM and e-procurement were selected as the research topic. More specifically, we discussed the implementation, the concept of e-procurement development guidelines, and prioritization. These three subtopics are important and interrelated. The research gap was summed using the DEMATEL method. The questionnaire was distributed to staff in the Directorate of E-procurement System Development, LKPP. The data were analyzed using DEMATEL. We also identified the most influential criteria. The results were discussed and concluded in the last research stage.

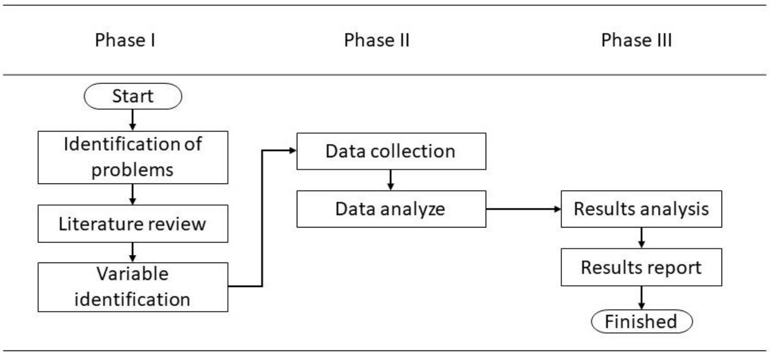

Figure 1. Stage of Research

Decision-Making Trial and Evaluation Laboratory (DEMATEL)

DEMATEL was developed by Natural Science and Humanities Research Plan proposed by Batelle Institute in 1971 [17], [18]. It is initially designed to identify complex global problems like racism, famine, environmental protection, and energy-saving [19].

The DEMATEL method is a method that can be used to analyze the influence of certain factors by compiling and forming relationships between criteria in a structured model that is easy to understand. DEMATEL is an analysis to provide values between the factors involved and determine the relationship[20]. Identification of factors using this analysis aims to determine the factors that are most dominant or have an influence on others. Using the DEMATEL method, researchers qualitatively extract the interrelationships between many factors in a problem. DEMATEL is also useful in considering the indirect effects of the various factors considered. The DEMATEL methodology is suitable for determining management decisions in complex situations. That is why the DEMATEL method was chosen in this study because it has not been applied to evaluate DSCM in e-procurement services

According to [21], [22] framework or algorithm in using the DEMATEL method and the calculation procedure consists of the following steps:

Step 1: Developing a measurement scale and determining the direction and degree of influence among factors.

In this step, various elements relevant to the IT innovation and their effect were identified and determined based on the literature review, brainstorming, and expert statements. Moreover, the degree of effect scale was designed to perform a paired comparison of the factors and determine the quality and degree of effects. The assessment scale is developed depending on the research purposes. The higher the assessment scale, the higher the probability that the questionnaire needs to be evaluated by experts. It is recommended to use a five-level scale (0-4), where 0= no relationship and effect, 1 = low effect, 2= moderate effect, 3= high effect, and 4= very high effect.

Step 2: Designing a direct-relation matrix

After determining the measurement scale significance, experts' judgments were calculated for the average value if this stage involves more than one expert. For every decision made by the experts, they were asked to determine the degree of direct effects between two variables based on the degree pair a, where they interpreted the effect of factor i on factor j in the matrix. Each expert's decision was turned into matrix n x n non-negative, constructed as = where k refers to the number of decision-making participants with 1≤ k ≤ p. Thus, 1, 2, 3, . . . , are the expert's answer (P), and each element of the matrix is an integer noted by The main diagonal of the matrix was considered to be 0.

$$X = \begin{bmatrix} 0 & x_{12} & \cdots & x_{n1} \\ x_{21} & 0 & \cdots & x_{n2} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & 0 \end{bmatrix} \quad (1)$$

Step 3: direct-relation matrix normalization
Direct-relation matrix X was normalized into matrix K. the main diagonal of the matrix was still 0 and the maximum number of row and column was 1.

$$K = \min\left[\frac{1}{\underset{1 \le i \le n}{Max}(\Sigma_{=1}^{n} x_{ij})}\right]\ i.j = 1,2,\ \ldots,\ n \quad (2)$$

$$N = K.X \quad (3)$$

Step 4: Calculate total-relation matrix
Total relation matrix was obtained using equation 5, where T was the matrix showing a total relation in each criteria pair, I was the identity matrix, and N was the normalized direct-relation matrix.

$$T = N(I - N)^{-1} \quad (5)$$

Step 5: Evaluating the number rows and columns of matrix (T)
The number of rows and columns in total-relation matrix are represented by vectors D and R, respectively.

$$D = [D_i]_{nx1} = (\Sigma_{j=1}^{n} t_{ij})_{nx1} \quad (i = 1,2, \ldots, n) \quad (6)$$

$$R = [R_i]_{nx1} = (\Sigma_{1=1}^{n} t_{ij})_{nx1} \quad (i = 1,2, \ldots, n) \quad (7)$$

The next step was determining the degree of central roles and their relationship. (D+R) represented the value of the central role, classified as prominence, and described the general direction of the effect. This value represents the core level of the service attribute. Parameter D-R was defined as the ratio of service effects. This value denotes the extent of an attribute's effect, where a positive value means that the attribute serves as the cause, while a negative value means that the attribute serves as the effect.

RESULT AND DISCUSSION

As mentioned previously, this study applied DEMATEL method to identify the intensity of relationships among the variables/factors/criteria. The DSCM criteria were identified through two stages: literature study and discussions with LKPP staffs, as shown in the following table.

Table 1. Expert's agreement of DSCM

DIGITAL SUPPLY CHAIN MANAGEMENT	
VARIABLE	**CRITERIA**
Digital Planning	P1. The planning stage involves P2 distribution requirement process
	P2. Inventory planning/control
	P3. Production planning
	P4. Material planning
	P5. Capacity planning
	P6. Financial plan
Digital Supply	P7. Supply tracing and supplier
	P8. Supplier selection
	P9. Delivery from supplier
	P10. Delivery and inspection
	P11. Payment alignment to suppliers
	P12. Supplier performance evaluation
Digital Manufacture	P13. Quality control
	P14. Inventory management (inbound and outbound)
Digital Logistics	P15. Transportation Management
	P16. Distribution

After the DSCM criteria identification, the next step was to examine the interrelations among criteria to determine the most dominant parameter in LKPP. The followings are the six stages of the DEMATEL calculation method:

1. Evaluation scale

The Direct-relation matrix was designed using a 5-point Likert scale, ranging from 0 to 4 (0 = no effect, 1= low effect, 2= moderate effect, 3= high effect, and 4= very high effect). This scale was developed based on the study conducted by [23]. This study involved 15 experts in identifying the relationships among 16 DSCM implementation criteria.

2. Direct-relation matrix

In this stage, DSCM results were recapitulated following the assessment scale. Each point in the direct-relation matrix comes from the average score of fifteen matrix questionnaires, which was then named matrix x, and the main diagonal of the matrix was 0. Table 2 Presents the recapitulation of DSCM direct relations.

Table 2. Direct Relation Matrix (X)

CRITERIA	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
P1	0	3,600	3,400	3,333	3,067	3,267	3,333	2,800	3,267	3,067	3,133	3,533	3,467	2,867	3,200	3,000
P2	3,200	0	2,800	3,200	3,133	3,200	3,267	2,933	3,200	3,200	2,933	3,067	3,333	3,133	3,000	3,133
P3	2,933	3,200	0	3,333	3,400	3,400	3,400	3,467	3,067	3,267	2,867	2,733	3,000	2,933	3,400	2,733
P4	3,467	3,000	2,933	0	3,267	3,333	3,267	3,133	3,200	3,200	3,067	3,067	3,133	3,200	3,000	3,133
P5	3,400	3,067	3,267	2,867	0	3,000	3,133	3,067	3,067	3,267	3,400	3,133	3,133	3,133	3,000	3,333
P6	2,867	3,000	3,200	3,333	3,267	0	3,000	3,267	3,267	3,133	2,867	3,267	3,333	3,333	3,400	2,933
P7	3,400	2,867	3,067	2,933	3,200	2,867	0	2,800	3,000	3,267	3,333	3,200	3,133	3,600	3,467	3,467
P8	3,000	3,133	2,933	3,133	3,067	3,067	3,267	0	3,133	2,733	3,400	3,333	3,467	3,067	3,067	3,067
P9	3,067	3,000	3,067	3,400	3,533	3,333	3,067	3,267	0	3,000	3,133	3,067	3,200	3,067	3,200	3,133
P10	3,000	2,933	3,267	3,133	3,267	3,400	3,333	3,000	3,000	0	3,200	3,067	3,133	3,067	3,467	3,533
P11	3,333	3,067	3,200	3,000	2,867	3,133	2,733	3,200	2,800	3,533	0	3,267	3,000	3,200	3,200	2,933
P12	3,000	3,333	3,533	3,400	3,067	3,400	2,867	3,200	3,133	3,133	3,067	0	3,067	3,000	2,933	3,067
P13	3,467	3,067	3,133	2,867	3,000	3,000	3,267	3,067	3,333	3,133	2,933	3,000	0	3,267	3,267	3,000
P14	3,267	3,333	3,133	3,000	3,067	3,000	3,133	3,133	3,333	3,133	3,200	3,067	3,067	0	3,067	3,267
P15	3,133	3,200	3,133	2,933	3,533	3,133	2,933	3,067	2,933	3,333	3,333	3,533	3,200	3,333	0	3,133
P16	3,067	3,267	3,000	2,867	3,267	3,067	3,200	3,133	3,133	3,200	3,067	3,000	2,933	3,200	3,000	0

3. Normalisasi direct-relation matrix

The direct-relation matrix N was then normalized into a generalized direct-relation matrix. It was done by, first, finding the K-value by adding points in the matrix of each row. Based on the addition results of each point in the row, the highest value was selected, which in this case was 48.333. The K-value was obtained using equation 2, i.e., by selecting the maximum value in the row. The k-value was

K= 1/48,333 atau 0,020689

K-value was used to normalize the direct-relation matrix (N) using equation 4, i.e., by multiplying K-value by the generalized direct-relation matrix. The results of the normalization of the direct relation matrix can be seen in Table 3.

Tabel 3. The Normalization Direct Relation Matrix (N)

Criteria	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
P1	0	0,0745	0,0703	0,0690	0,0634	0,0676	0,0690	0,0579	0,0676	0,0634	0,0648	0,0731	0,0717	0,0593	0,0662	0,0621
P2	0,0662	0	0,0579	0,0662	0,0648	0,0662	0,0676	0,0607	0,0662	0,0662	0,0607	0,0634	0,0690	0,0648	0,0621	0,0648
P3	0,0607	0,0662	0	0,0690	0,0703	0,0703	0,0703	0,0717	0,0634	0,0676	0,0593	0,0566	0,0621	0,0607	0,0703	0,0566
P4	0,0717	0,0621	0,0607	0	0,0676	0,0690	0,0676	0,0648	0,0662	0,0662	0,0634	0,0634	0,0648	0,0662	0,0621	0,0648
P5	0,0703	0,0634	0,0676	0,0593	0	0,0621	0,0648	0,0634	0,0634	0,0676	0,0703	0,0648	0,0648	0,0648	0,0621	0,0690
P6	0,0593	0,0621	0,0662	0,0690	0,0676	0	0,0621	0,0676	0,0676	0,0648	0,0593	0,0676	0,0690	0,0690	0,0703	0,0607
P7	0,0703	0,0593	0,0634	0,0607	0,0662	0,0593	0	0,0579	0,0621	0,0676	0,0690	0,0662	0,0648	0,0745	0,0717	0,0717
P8	0,0621	0,0648	0,0607	0,0648	0,0634	0,0634	0,0676	0	0,0648	0,0566	0,0703	0,0690	0,0717	0,0634	0,0634	0,0634
P9	0,0634	0,0621	0,0634	0,0703	0,0731	0,0690	0,0634	0,0676	0	0,0621	0,0648	0,0634	0,0662	0,0634	0,0662	0,0648
P10	0,0621	0,0607	0,0676	0,0648	0,0676	0,0703	0,0690	0,0621	0,0621	0	0,0662	0,0634	0,0648	0,0634	0,0717	0,0731

Criteria	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
P11	0,0690	0,0634	0,0662	0,0621	0,0593	0,0648	0,0566	0,0662	0,0579	0,0731	0	0,0676	0,0621	0,0662	0,0662	0,0607
P12	0,0621	0,0690	0,0731	0,0703	0,0634	0,0703	0,0593	0,0662	0,0648	0,0648	0,0634	0	0,0634	0,0621	0,0607	0,0634
P13	0,0717	0,0634	0,0648	0,0593	0,0621	0,0621	0,0676	0,0634	0,0690	0,0648	0,0607	0,0621	0	0,0676	0,0676	0,0621
P14	0,0676	0,0690	0,0648	0,0621	0,0634	0,0621	0,0648	0,0648	0,0690	0,0648	0,0662	0,0634	0,0634	0	0,0634	0,0676
P15	0,0648	0,0662	0,0648	0,0607	0,0731	0,0648	0,0607	0,0634	0,0607	0,0690	0,0690	0,0731	0,0662	0,0690	0	0,0648
P16	0,0634	0,0676	0,0621	0,0593	0,0676	0,0634	0,0662	0,0648	0,0648	0,0662	0,0634	0,0621	0,0607	0,0662	0,0621	0

4. Calculate total relation matrix

The total relation matrix (T) was obtained by multiplying the direct-relation matrix normalization result by the inverse of the result of subtracting matrix N from the identity matrix. Using equation (5), the total relation matrix (T) was calculated using MatLab. The calculation result is presented in Table 4.

Tabel 4. Total Direct Relation Matrix (T)

Criteria	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
P1	2,7604	2,8008	2,7977	2,7775	2,8418	2,8235	2,8030	2,7567	2,7838	2,8203	2,7848	2,8142	2,8273	2,8055	2,8263	2,7791
P2	2,7370	2,6467	2,7020	2,6908	2,7567	2,7366	2,7169	2,6753	2,6982	2,7371	2,6968	2,7206	2,7393	2,7252	2,7369	2,6973
P3	2,7539	2,7303	2,6688	2,7147	2,7837	2,7621	2,7410	2,7064	2,7173	2,7601	2,7173	2,7363	2,7551	2,7433	2,7662	2,7115
P4	2,7779	2,7409	2,7402	2,6642	2,7955	2,7751	2,7526	2,7142	2,7338	2,7731	2,7349	2,7565	2,7718	2,7623	2,7731	2,7328
P5	2,7687	2,7343	2,7385	2,7124	2,7242	2,7612	2,7424	2,7053	2,7235	2,7665	2,7332	2,7498	2,7638	2,7531	2,7652	2,7286
P6	2,7701	2,7440	2,7482	2,7318	2,7987	2,7138	2,7509	2,7199	2,7381	2,7751	2,7344	2,7632	2,7785	2,7679	2,7835	2,7322
P7	2,7871	2,7488	2,7530	2,7315	2,8047	2,7770	2,6996	2,7184	2,7403	2,7849	2,7501	2,7693	2,7820	2,7799	2,7920	2,7491
P8	2,7395	2,7137	2,7106	2,6956	2,7616	2,7403	2,7229	2,6241	2,7030	2,7348	2,7114	2,7316	2,7478	2,7301	2,7443	2,7020
P9	2,7771	2,7473	2,7491	2,7363	2,8069	2,7817	2,7554	2,7231	2,6781	2,7760	2,7426	2,7630	2,7795	2,7664	2,7832	2,7392
P10	2,7901	2,7602	2,7668	2,7454	2,8165	2,7971	2,7744	2,7322	2,7505	2,7319	2,7578	2,7772	2,7924	2,7806	2,8024	2,7605
P11	2,7251	2,6924	2,6954	2,6733	2,7375	2,7213	2,6931	2,6663	2,6769	2,7290	2,6256	2,7102	2,7190	2,7121	2,7264	2,6795
P12	2,7576	2,7354	2,7396	2,7186	2,7801	2,7648	2,7338	2,7042	2,7211	2,7603	2,7233	2,6851	2,7589	2,7470	2,7602	2,7200
P13	2,7459	2,7105	2,7122	2,6888	2,7584	2,7371	2,7209	2,6817	2,7047	2,7399	2,7009	2,7235	2,6789	2,7316	2,7459	2,6988
P14	2,7627	2,7356	2,7325	2,7114	2,7803	2,7576	2,7388	2,7031	2,7249	2,7605	2,7260	2,7451	2,7590	2,6887	2,7628	2,7239
P15	2,7960	2,7685	2,7679	2,7452	2,8246	2,7957	2,7705	2,7368	2,7527	2,7998	2,7636	2,7890	2,7971	2,7887	2,7388	2,7566
P16	2,7162	2,6919	2,6876	2,6668	2,7407	2,7159	2,6975	2,6611	2,6789	2,7188	2,6813	2,7012	2,7137	2,7081	2,7186	2,6184

5. Evaluating the number of matrix rows and columns

After obtaining the total relation matrix, the next step was applying equations (6) and (7) to find out the dispatcher vector (Di) by summing up every row in total direct relation matrix. It was followed by approximating receiver vector (Ri) by summing up every column in total direct relation matrix. Di and Ri vectors calculations were performed to obtain prominence Di+Ri and relation Di-Ri. Di+Ri results indicated the importance level of DSCM in e-procurement, while relation Di-Ri indicated the causal relationship of DSCM. The values of D+R and D−R provided the coordinate points in the quadrant, as shown in Table 5.

Table 5. Prominence and relation results obtained by using the DEMATEL method

Criteria	Di	Ri	Di+Ri	Di-Ri
Distribution requirement planning	44,80271	44,1653	88,96801	0,637416
Inventory planning/control	43,4133	43,70111	87,11441	-0,2878
Production planning	43,76799	43,70998	87,47797	0,058017
Material planning	43,99885	43,40426	87,40311	0,594588
Capacity planning	43,87062	44,51195	88,38257	-0,64134
Financial plan	44,05036	44,16095	88,21131	-0,1106
Supply tracing and supplier	44,16771	43,81363	87,98134	0,354083
Supplier selection	43,51328	43,22893	86,74221	0,284353
Delivery from supplier	44,10483	43,52586	87,63069	0,578974
Delivery and inspection	44,33632	44,16816	88,50448	0,168162

Criteria	Di	Ri	Di+Ri	Di-Ri
Payment alignment to suppliers	43,18306	43,58396	86,76702	-0,4009
Supplier performance evaluation	43,81005	43,93578	87,74583	-0,12573
Quality control	43,47983	44,16416	87,64399	-0,68433
Inventory management (inbound and outbound)	43,81276	43,99047	87,80323	-0,17771
Transportation Management	44,39141	44,22565	88,61706	0,165765
Distribution	43,11658	43,52953	86,64611	-0,41295

Table 5 presents the effect of a criterion on another. Di+Ri value represents the total resistance index of the effect given and received by an indicator. In other words, the Di+Ri value reflects the priority of an indicator of a service. This value shows the effect of each indicator. Criteria with higher Di+Ri value indicates higher importance to be implemented in e-procurement, as they exhibited stronger effects on other criteria. A criterion with a positive Di-Ri value is categorized as a causal group, meaning that it tends to affect other criteria. On the other hand, those with negative Di-Ri value belongs to the affected group, meaning that they tend to be affected by other criteria.

As shown in Table 5 the indicator P1 exhibited the highest Di+Ri score (i.e., 88.96801), meaning that the criterion tends to affect other criteria. In other words, the criteria could strongly affect the LKPP's e-procurement service evaluation.

6. Designing DEMATEL causal diagram

Causal diagram was designed after obtaining the horizontal axis (Di+Ri) and vertical axis (Di-Ri). The Di+Ri value represents the degree of effect of a criterion, while Di-Ri value refers the causal relationship among the criteria and reflects the priority level. Causal Diagram is presented in the following Figure

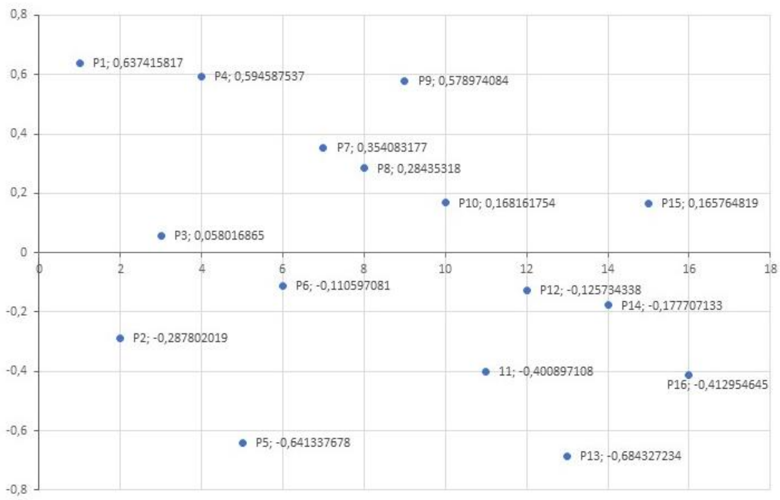

Figure 2. Casual Diagram

Figure 2 presents the distribution of all criteria in terms of the importance and relationship values. The result appears to show that all criteria are important, as indicated by the positive value in the horizontal axis. The causal matrix shows that P1, i.e., distribution process requirement, is the most significant criterion with the highest Di-Ri value with a strong, positive relationship value. This criterion could be considered a dispatcher since it significantly affects LKPP’s e-procurement service evaluation and implementation success. Similar results were also noticed in criteria (P4), (P9), (P7), (P8), (P10), (P15), and (P3).

Meanwhile, criteria (P6), (P12), (P14), (P2), (P11), (P16), and (P5) could be considered as receivers because they exhibited negative effects and strong, positive relationships. These criteria were likely influenced by other criteria. Criterion P13 was found to be the most affected criterion with a weaker relationship than other criteria.

The next step was to make the impact diagram map to picture the effect and interrelationship among DSCM. It was made based on the alpha value threshold obtained by calculating the average total direct-relation matrix. The average total direct-relation matrix (2.7415) was compared to the threshold, and if the Alpha value threshold was higher than the total direct-relation matrix, it means that DSCM is related to or affects other DSCMs. On the other hand, if the alpha value threshold was lower than DSCM, it indicated no strong relationship, and the data thus could be deleted. The eliminated direct-relation matrix is called the impact-diagram map, presented in Table 6.

Table 6. Impact Diagram Map DEMATEL

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**P12**	**P13**	**P14**	**P15**	**P16**
P1	2,760	2,801	2,798	2,777	2,842	2,824	2,803	2,757	2,784	2,820	2,785	2,814	2,827	2,806	2,826	2,779
P2					2,757											
P3	2,754				2,784		2,741			2,760			2,755	2,743	2,766	
P4	2,778				2,795	2,775	2,753			2,773		2,757	2,772	2,762	2,773	
P5	2,769					2,761	2,742			2,767		2,750	2,764	2,753	2,765	
P6	2,770	2,744	2,748				2,751			2,775		2,763	2,779	2,768	2,783	
P7	2,787	2,749	2,753		2,805	2,777				2,785	2,750		2,782	2,780	2,792	2,749
P8					2,762								2,748		2,744	
P9	2,777	2,747	2,749		2,807	2,782	2,755			2,776	2,743	2,763	2,779	2,766	2,783	
P10	2,790	2,760	2,767	2,745	2,817	2,797	2,774		2,751		2,758	2,777	2,792	2,781	2,802	2,761
P11																
P12	2,758				2,780	2,765				2,760			2,759	2,747		
P13	2,746				2,758										2,746	
P14	2,763				2,780	2,758				2,760		2,745	2,759		2,763	
P15	2,796	2,768	2,768	2,745	2,825	2,796	2,770		2,753	2,800	2,764	2,789	2,797	2,789		2,757
P16																

7. Determine Key Criterion Outcomes

The end result of this study is to prioritize the DSCM criteria so that the criteria will be implemented first in the development of e-procurement services. Table 7 is the result of the priority ranking of DSCM implementation.

In this study, determining the main priority can be seen from the results of calculating the Di+Ri and Di-Ri vectors (the greater the Di+Ri and Di-Ri values, the greater the priority). Apart from that, pay attention to the impact diagram map by looking at the ranking of the highest number of relationships between criteria. The more relationships, the greater the influence of the successful implementation of DSCM. If each criterion occupies the highest score from the results of both calculations, then it is made a top priority in development.

Table 7. Key Criterion Outcomes

Criteria	Vector		Total Relationship	Priority Ranking
	Di+Ri	Di-Ri		
Distribution requirement planning	88,96801	0,165765	16	1
Transportation mangement	88,61706	0,168162	14	2
Delivery and inspection	88,50448	0,168162	14	3
Delivery from supplier	87,63069	0,578974	12	4
Supply tracing and supplier	87,98134	0,354083	11	5
Material planning	87,40311	0,594588	9	6
Production planning	87,47797	0,058017	7	7
Supplier selection	86,74221	0,284353	3	8

CONCLUSION

This study identifies factors affecting DSCM implementation in an e-procurement service. DSCM criteria were determined based on the literature study. Four DSCM components were taken from the literature study: digital planning, digital supply, digital manufacture, and digital logistics. These components were divided into sixteen criteria according to LKPP's e-procurement service: 6 criteria for digital planning, 6 criteria for digital supply, two criteria for digital manufacturing, and 2 criteria for digital logistics. DEMATEL method was applied to determine the causal relationship among these criteria. The result shows that DSCM implementation significantly affects the inventory planning/control, capacity planning, financial plan, payment alignment to suppliers, supplier performance evaluation, quality control, inventory management (inbound and outbound), and distribution. Therefore, it is important to implement DSCM in LKPP's e-procurement service as it could improve the supply chain management performance. The analysis result shows that eight criteria in the dispatcher group serve need to be prioritized in DSCM of LKPP's e-procurement service. Meanwhile, the other eight criteria were in the receiver group, showing that the DSCM implementation in LKPP's e-procurement has been partially in line with the DSCM principle. The distribution requirement planning was found to be the most important criterion and hence should be prioritized to improve the e-procurement service. Proper distribution planning could potentially improve the e-procurement service and enhance the quality of other criteria. Criteria prioritization presented in this study could serve as the basis for e-procurement service development.

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