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Evaluating the Weights of Criteria for Decoupling Point Positioning I

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Abstract

Today, enterprises might implement different supply chain strategies for different products in order to survive and to increase their market shares. The use of alternative supply chain strategies requires different decoupling points. But positioning this point for leagile strategies is not as easy as in lean and agile supply chains. The purpose of this study is to calculate the weights of criteria effective in determining the position of a decoupling point for the leagile strategy of a furniture components manufacturing firm. For that purpose a two-stage decision making method was used. In the first stage, Fuzzy Dematel method was used to determine the interactions and causal relationships between criteria and to identify the causal diagram. In the second stage, weights of criteria were calculated by Dematel based Analytic Network Process method. The findings revealed that the most important criterion was backorder cost.

Keywords: leagile supply chain; decoupling point; Dematel based analytic network process; Dematel; ANP; supply chain strategy;

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1. Introduction

Businesses are faced with various factors in the market nowadays, such as the increase in the number of product variety but shortening of product life cycle, emergence of new technologies, and expectations of customers type of goods and services provided with lower cost yet in the time demanded by them, and these factors make it more difficult to survive in the roughly competitive environment. Continuous improvement in order to keep up with the developments in the market is required for success of businesses who are striving not only to survive but also to expand and compete.

Maintaining competitive advantage requires using an efficient supply chain strategy suitable for the products while meeting the expectations of customers. Businesses have realized the significance of managing competition between supply chains to achieve their objectives in this period of change (Christopher & Towill, 2002). A successful strategy has become one of the primary factors that businesses have to manage in order to satisfy their customers and keep up with the changes in the market. Designing a supply chain strategy by considering the constraints and needs of the market, product features, and internal processes of the companies will definitely be effective in firm success.

Using a one-size fits all strategy for all the products of a business fails to satisfy customer expectations at the right time and in the right way, and this has compelled businesses to use different supply chain strategies for different products. Although two main supply chain strategies, lean and agile, are prevalently mentioned in the literature (Mason-Jones, Naylor & Towill, 2000a; Naylor & Towill, 2000b; Christopher & Towill, 2001; Hallgren & Olhager, 2009; Vinodh, Sundaraj & Devadasan, 2009), "leagile" strategy using both of them together have recently been preferred by the businesses depending on the structure of the market, product or business process (Ambe, 2010).

Choosing the type of supply chain strategy for products with different features is a managerial decision. Decision making is a process where an alternative that assists the firm to attain its goals is chosen in order to survive. Managers have to adapt to the rapidly changing conditions, and take quick and correct decisions in the fiercely competitive environment. They prefer employing scientific methods to make effective decisions using qualitative and quantitative criteria (Dagdeviren, Eraslan, Kurt & Dizdar, 2005).

Preferring either lean or agile strategy by the firms depends on cost and responsiveness factors, respectively. However, using both of the strategies as "leagile" is a decision that needs to be inquired in detail. The critical question is how to use these two strategies together in a supply chain. Naylor, Naim and Berry (1999) stated in 1999 that these strategies could be used with the help of the decoupling point (DP). DP is the final point in the value chain where a product is linked to a specific customer order, product features are frozen and most importantly, inventory is held (Olhager, 2010). Whereas it is easy to determine the DP for lean and agile strategies, it is more difficult to decide in leagile strategy. There are many criteria used in positioning DP along a supply chain. While using leagile strategy for certain products, managers have to analyze the criteria determining the position of DP and decide to which point the process will be "lean" and from which point onwards it should be "agile".

The purpose of this study is to calculate the weights of the criteria determining the position of a DP for a product family of a furniture components manufacturing firm which requires using leagile supply chain strategy. With this purpose, a two-stage decision making method was used. In the first stage, Fuzzy Dematel method was used because the determination of the interactions and causal relationships between criteria and identification of the causal diagram was desired. In the second stage, DANP (Dematel based ANP) method was preferred to calculate the criteria's weights.

The rest of the paper is organized as follows. Section 2 presents details on leagile supply chain strategy. Section 3 provides a brief summary of the methodologies employed. Section 4 presents the analyses and findings. The final section concludes the study and provides a general evaluation.

2. Leagile Supply Chain Strategy

The purpose of using lean supply chain is to reduce the costs and eliminate the losses, and it is an effective strategy for the markets with stable and thus predictable demand, and limited product range (Hilletofth, 2009). Agile supply chain, on the other hand, is a strategy that has the ability to benefit from profitable opportunities in a volatile market by using market knowledge and virtual cooperations (Naylor, Naim & Berry, 1999). In agile supply chain, production and distribution is led by real demands. Using lean and agile strategies together is referred to as leagile strategy.

Leagile strategy is used where only lean or only agile strategy does not provide sufficient solutions. This strategy, using complementary lean and agile strategies together, produces and delivers a wide range of products with low cost and on time. This supply chain is expected to be both lean and agile (Stavrulaki & Davis, 2010). Also this strategy will enable firms to easily overcome cost reduction, mass customization and adapting to the future changes (Huang, Uppal & Shi, 2002).

One of the methods of using lean and agile strategies together in a leagile strategy is DP approach referred to as strategic stock. The purpose of this approach is to hold the inventory in the generic or modular form and complete the product upon a precise customer order (Christopher & Towill, 2001; Ferreira & Alcantara, 2016).

DP, also referred to as customer order penetration point, is inherent in flow of goods where production performed through forecast diverges from production performed upon customer orders (Wikner & Rudberg, 2005). In addition to positioning of DP along the chain which affects production and inventory costs, order responsiveness time, mass customization, sales and supply chain profitability, it is also very important to determine the effects of different factors changing its position (Olhager, 2003; Wu, Ma, Yang, & Sun, 2008). Determining the position of DP on the chain preserves the optimal balance between productivity and flexibility and its position is affected by various markets-, product- and process-related criteria (Van Donk, 2000; Van Donk, 2001; Olhager, 2003; Rafiei & Rabbani, 2011; Zaerpour, Rabbani, Gharahgozli & Tavakkoli-Moghaddam, 2009; Hemmati & Rabbani, 2010).

Managers who would like to use leagile strategy have to make the right decision on positioning DP along the chain. This point will enrich competitiveness of the business in the subject, products, enable customers to achieve the products in the time they demand and gain competitive advantage.

3. Methodology

This study employs two-stage fuzzy Dematel and DANP methods together to calculate weights of criteria influencing the position of DP along a leagile supply chain. The methods are detailed below respectively.

3.1. Fuzzy Dematel

Fuzzy Dematel method is used in this study to convert the relationship between causes and effects of criteria into a cognizable structural model in a fuzzy environment (Hsu, Chen & Tzeng, 2007). The steps of Fuzzy Dematel method are as follows (Nawaz, Reza & Sarwar, 2016; Wu & Lee, 2007):

Step 1: Evaluating the criteria using fuzzy linguistic scale: In order to deal with the ambiguities of human assessments in evaluations, fuzzy linguistic scale consisting of five linguistic terms (no influence, very low influence, low influence, high influence, and very high influence) are used (Wu &

Lee, 2007; Chang, Chang & Wu, 2011).

Step 2: Aggregating the assessments of decision makers and deriving average matrix: The evaluations are defuzzified by converting fuzzy data into crisp scores (CFCS) method and converted into crisp scores (Opricovic & Tzeng, 2003). Direct-relation matrix Z is obtained in this step.

Step 3: Normalizing the direct-relation matrix: Normalized direct-relation matrix X is performed as written below.

$$X = s.Z \quad (1)$$

$$s = \frac{1}{\sum^{n}} \quad i, j = 1, .., n \quad (2)$$

Step 4: Attaining total-relation matrix: Total relation matrix is computed as written below.

$$T = X(1-X)^{-1} \quad (3)$$

Step 5: Setting a threshold value and producing a causal diagram: In order to filter some of the negligible effects in matrix T, which is obtained to explain the structural relations between criteria while holding system complexity in a manageable level, p threshold value is used. In a causal diagram, the criteria affecting Matrix T with a value greater than the threshold are selected and displayed.

Sum of rows and sum of columns of matrix T are denoted by D and R respectively. Causal diagram is obtained by using (D_i+R_j, D_i-R_j) data (Wu, 2008). D_i+R_j and D_i-R_j are named as "prominence" and "relation", respectively (Tseng & Lin, 2009).

3.2. Dematel based ANP (DANP)

Normalization is obtained by dividing each criterion in a column by the number of clusters in a traditional ANP. Thus each column will sum to unity implicitly. But assuming equal weighting of each cluster in obtaining a weighted supermatrix appears irrational because the degree of influence among the criteria differs (Hsu, Wang & Tzeng, 2012). Therefore DANP method is used in this study to calculate the weights of criteria. The steps of the method are as follows (Kuo, Hsu & Li, 2015; Hung & Lee, 2016):

Step 1: Establishing unweighted supermatrix: Total effect matrix T_C, displaying interrelations between criteria, is the matrix T obtained by Dematel method. Normalization of matrix T_C reveals a new matrix T_C^{α}, presented in Equation (4). For normalization, sum of each row of each cluster is divided by the values on that row.

$$T_C^{\alpha} = \begin{vmatrix} \vdots & \cdots & \vdots & \cdots & \vdots \\ t_c^{\alpha i1} & \cdots & t_c^{\alpha ij} & \cdots & t_c^{\alpha 1n} \end{vmatrix} \quad (4)$$

$t_C^{\alpha 11}$ is normalised by Equations (5) and (6) and this process is continued until $t_C^{\alpha nn}$ is derived.

$$d_i^{11} = \sum t_{ij}^{11}, i = 1,2, \ldots, m_1 \quad (5)$$

$$T_C^{\alpha 11} = \begin{bmatrix} t_{c11}^{11}/d_1^{11} & \cdots & t_{c1j}^{11}/d_1^{11} & \cdots & t_{c1m_1}^{11}/d_1^{11} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_{ci1}^{11}/d_i^{11} & \cdots & t_{cij}^{11}/d_i^{11} & \cdots & t_{cim_1}^{11}/d_i^{11} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_{cm_11}^{11}/d_{m_1}^{11} & \cdots & t_{cm_1j}^{11}/d_{m_1}^{11} & \cdots & t_{cm_1m_1}^{11}/d_{m_1}^{11} \end{bmatrix} = \begin{bmatrix} t_{c11}^{\alpha 11} & \cdots & t_{c1j}^{\alpha 11} & \cdots & t_{c1m_1}^{\alpha 11} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_{ci1}^{\alpha 11} & \cdots & t_{cij}^{\alpha 11} & \cdots & t_{cim_1}^{\alpha 11} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_{cm_11}^{\alpha 11} & \cdots & t_{cm_1j}^{\alpha 11} & \cdots & t_{cm_1m_1}^{\alpha 11} \end{bmatrix} \quad (6)$$

Unweighted supermatrix is displayed in Equation (7). The new matrix composed is based on transpose T_C^{α} matrix.

$$W = (T_C^{\alpha})' = \begin{vmatrix} \vdots & \cdots & \vdots & \cdots & \vdots \\ W^{1j} & \cdots & W^{ij} & \cdots & W^{nj} \end{vmatrix} \quad (7)$$

Step 2: Obtaining weighted supermatrix: Total relation matrix (T_D matrix) of dimensions (clusters) , which is derived by Dematel method, is normalized and matrix T_D^{α} which is displayed in Equation (9) is derived.

$$T_D = \begin{vmatrix} \vdots & \cdots & \vdots & \cdots & \vdots \\ t_D^{i1} & \cdots & t_D^{ij} & \cdots & t_D^{1n} \end{vmatrix} \quad (8)$$

$$\sum_{j=1}^{n} t_D^{ij} = d_i \quad i = 1,2,\ldots,n.$$

$$T_D^{\alpha} = \begin{bmatrix} t_D^{11}/d_1 & \cdots & t_D^{1j}/d_1 & \cdots & t_D^{1n}/d_1 \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_D^{i1}/d_i & \cdots & t_D^{ij}/d_i & \cdots & t_D^{in}/d_i \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_D^{n1}/d_n & \cdots & t_D^{nj}/d_n & \cdots & t_D^{nn}/d_n \end{bmatrix} = \begin{bmatrix} t_D^{\alpha 11} & \cdots & t_D^{\alpha 1j} & \cdots & t_D^{\alpha 1n} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_D^{\alpha i1} & \cdots & t_D^{\alpha ij} & \cdots & t_D^{\alpha in} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_D^{\alpha n1} & \cdots & t_D^{\alpha nj} & \cdots & t_D^{\alpha nn} \end{bmatrix} \quad (9)$$

Then, weighted supermatrix is calculated with the Equation (10).

$$W^{\alpha} = T_D^{\alpha} W = \begin{bmatrix} t_D^{\alpha 11} \times W^{11} & \cdots & t_D^{\alpha i1} \times W^{i1} & \cdots & t_D^{\alpha n1} \times W^{n1} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_D^{\alpha 1j} \times W^{1j} & \cdots & t_D^{\alpha ij} \times W^{ij} & \cdots & t_D^{\alpha nj} \times W^{nj} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ t_D^{\alpha 1n} \times W^{1n} & \cdots & t_D^{\alpha in} \times W^{in} & \cdots & t_D^{\alpha nn} \times W^{nn} \end{bmatrix} \quad (10)$$

Step 3: Limiting the weighted supermatrix: "The weighted supermatrix is limited by raising it to a sufficiently large power *k* until the supermatrix converges and becomes a long-term stable supermatrix to obtain DANP weights" (Kuo et al., 2015).

4. Application

Based on the fact that using one-size fits all strategy for all the products does not foreground a firm in this competitive environment, supply chain strategy matching was planned for all the products of a furniture components manufacturing firm. The calculations revealed that lean supply chain is suitable for functional products/product families, whereas agile supply chain strategy matching is appropriate for innovative products/product families. All the products besides functional and innovative products, which are the subject matter of the study, are matched with leagile supply chain. In order to calculate the weights of criteria affecting the position of DP along leagile supply chain, two-stage fuzzy Dematel-DANP methods were used together in this study.

For the subject product family of the firm, which is among the product families where leagile supply chain strategy should be used, eleven criteria were determined by the experts in order to determine the best position of DP. These criteria were grouped under three dimensions as market-related (C_1), product-related (C_2) and process-related (C_3). The criteria of predictability of demand (C_{11}), delivery reliability (C_{12}), delivery lead time (C_{13}), order size (C_{14}), order frequency (C_{15}), modular product design (C_{21}), holding cost (C_{22}), backorder cost (C_{23}), production lead time (C_{31}), process and human resources flexibility (C_{32}) and location of the bottleneck (C_{33}) were deemed as determinants of DP position.

In the first phase of the study, the interactions and relations among all dimensions and criteria were analyzed through Fuzzy Dematel Method. Fuzzy evaluations of the decision makers on the dimensions were defuzzified by CFCS method. Matrix *Z*, matrix *X* and matrix *T* were calculated by Fuzzy Dematel by using Equation 1, Equation 2 and Equation 3, respectively. Sum of rows and sum of columns of matrix *T* is displayed in Table 1. Threshold value was calculated as 4,063 by averaging matrix *T* (Altuntas & Yılmaz, 2016). Values which were greater than threshold value are presented in Table 1 and were denoted with t_{ij}^{*}.

Table 1. Sum of Rows and Columns of Dimensions

	C_1	C_2	C_3	D_i	R_j	D_i+R_j	D_i-R_j
C_1	3,564	4,761*	4,575*	12,900	10,649	23,549	2,252
C_2	3,800	4,317*	4,516*	12,632	13,180	25,812	-0,548
C_3	3,285	4,102*	3,645	11,032	12,736	23,768	-1,704

When the D_i+R_j values of the dimensions are evaluated, it is clear that product dimension with the value of 25,812 is of critical importance. Market is determined as having the least significance among three dimensions. According to D_i-R_j values, the dimensions are handled in two groups as cause and effect. In this study, market dimension is considered under the cause group as its D_i-R_j value is positive (2,252). Moreover, its direct effect over other criteria can be inferred from its having the highest D_i-R_j value. C_2 and C_3 are listed in effect group with their values of -0,548 and -1,704. C_2 dimension is affected by all dimensions, including itself. Causal diagram regarding these dimensions is presented in Figure 1. The study then analyzed the interactions and relations among all criteria. As a result, total relation matrix *T* was calculated (Table 2).

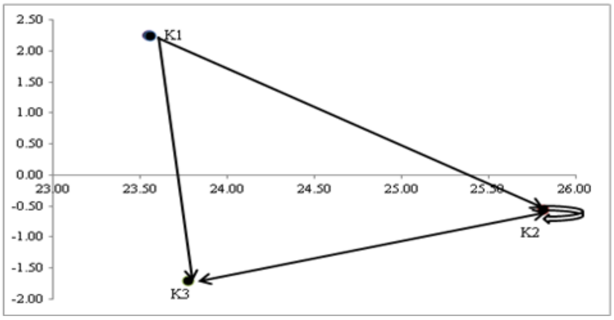

Figure 1. Causal Diagram Between Dimensions

Table 2. Matrix *T* of All Criteria

$$T = \begin{bmatrix} 0{,}185 & 0{,}247 & 0{,}374 & 0{,}316 & 0{,}340 & 0{,}223 & 0{,}342 & 0{,}329 & 0{,}312 & 0{,}275 & 0{,}301 \\ 0{,}221 & 0{,}186 & 0{,}386 & 0{,}303 & 0{,}318 & 0{,}232 & 0{,}308 & 0{,}324 & 0{,}324 & 0{,}288 & 0{,}286 \\ 0{,}337 & 0{,}368 & 0{,}419 & 0{,}444 & 0{,}451 & 0{,}339 & 0{,}477 & 0{,}480 & 0{,}474 & 0{,}434 & 0{,}444 \\ 0{,}265 & 0{,}260 & 0{,}417 & 0{,}270 & 0{,}355 & 0{,}263 & 0{,}379 & 0{,}368 & 0{,}395 & 0{,}319 & 0{,}315 \\ 0{,}297 & 0{,}263 & 0{,}429 & 0{,}340 & 0{,}282 & 0{,}262 & 0{,}391 & 0{,}364 & 0{,}382 & 0{,}330 & 0{,}319 \\ 0{,}202 & 0{,}237 & 0{,}349 & 0{,}289 & 0{,}291 & 0{,}194 & 0{,}313 & 0{,}332 & 0{,}353 & 0{,}302 & 0{,}312 \\ 0{,}276 & 0{,}308 & 0{,}481 & 0{,}392 & 0{,}404 & 0{,}330 & 0{,}332 & 0{,}448 & 0{,}426 & 0{,}371 & 0{,}388 \\ 0{,}301 & 0{,}325 & 0{,}495 & 0{,}415 & 0{,}412 & 0{,}327 & 0{,}434 & 0{,}351 & 0{,}450 & 0{,}386 & 0{,}419 \\ 0{,}274 & 0{,}267 & 0{,}423 & 0{,}372 & 0{,}372 & 0{,}324 & 0{,}385 & 0{,}404 & 0{,}324 & 0{,}381 & 0{,}390 \\ 0{,}256 & 0{,}249 & 0{,}397 & 0{,}328 & 0{,}348 & 0{,}288 & 0{,}351 & 0{,}369 & 0{,}390 & 0{,}260 & 0{,}350 \\ 0{,}263 & 0{,}249 & 0{,}391 & 0{,}319 & 0{,}330 & 0{,}291 & 0{,}345 & 0{,}367 & 0{,}368 & 0{,}328 & 0{,}263 \end{bmatrix}$$

Sum of rows and sum of columns of the matrix *T* of the criteria in the study are displayed in Table 3.

Table 3. Sum of Rows and Sum of Columns of All Criteria

	C_{11}	C_{12}	C_{13}	C_{14}	C_{15}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}
D_i	3,243	3,176	4,669	3,606	3,660	3,175	4,156	4,315	3,916	3,587	3,515
R_j	2,877	2,960	4,561	3,788	3,904	3,073	4,057	4,137	4,199	3,675	3,788
D_i+R_j	6,120	6,136	9,229	7,.394	7,564	6,248	8,213	8,452	8,115	7,262	7,303
D_i-R_j	0,366	0,216	0,108	-0,182	-0,243	0,103	0,099	0,178	-0,283	-0,088	-0,273

In order to determine an appropriate DP location along the chain for the product family analyzed, Dematel method was used for the 11 criteria and the interactions among these criteria were established.

While the cause group criteria C_{11}, C_{12}, C_{13}, C_{21}, C_{22}, C_{23} are net causers with their positive D_i-R_j values, C_{14}, C_{15}, C_{31}, C_{32} and C_{33}, which belong to effect group, are net receivers with their negative D_i-R_j values. Among the cause group, the one that has the highest *Di-Rj* value is "predictability of demand" (C_{11}) with a value of 0,366. This criterion affects other ones more than it is affected by them.

The second part of the study aims at calculating weights of criteria determining DP position using DANP method. For this study, primarily total effect matrix (T_C), displaying criteria interrelations, was generated. This is the matrix *T* obtained through the Fuzzy Dematel method in the first part of the study (Table 2). Later, matrix T_C was normalised and matrix T_C^{α} was obtained (Equation 5 and 6). Unweighted supermatrix (matrix *W*) was obtained by transposing T_C^{α} (Equation 7). Weighted supermatrix was derived.

Matrix T of dimensions which was calculated by Dematel method, is phrased as matrix T_D in this method. The new matrix T_D^{α} was calculated by normalising this matrix and weighted supermatrix was obtained by using Equation 8, Equation 9 and Equation 10. In the final stage of DANP method, limit supermatrix was derived in order to determine the long term, relative effects of criteria on each other. Weights of criteria obtained in fuzzy environment by DANP are displayed in Table 4.

Table4. Weights of Criteria Obtained by DANP Method

Criteria (i)	C_{11}	C_{12}	C_{13}	C_{14}	C_{15}	C_{21}	C_{22}	C_{23}	C_{31}	C_{32}	C_{33}
Weight (W_i)	0,046	0,048	0,074	0,061	0,063	0,100	0,128	0,132	0,125	0,109	0,113

Among these criteria, C_{23} (backorder cost) ranks the first with its weight of 13,2 %. When Dematel results of this criterion are considered, it is clear that C_{23} not only affects other criteria but is also affected by them. Moreover, its relation to numerous criteria proves its importance. As the inability to fulfill orders in time or not having enough stocks in times of demand causes this cost, improvement of this criterion which is crucial for the firm plays a significant role in determining appropriate DP.

The second criterion listed as a cause group, according to Dematel method is C_{22} (holding cost) with its weight of 12,8 %. The top two factors in the list of criteria according to their significance are cost-related factors and they must be considered when positioning DP. When this cost item is high due to holding after production, the firm should give up making to stock and start production following specific customer order. Positioning DP suitably along the chain is closely related to the strategic choice of the firm.

The criterion ranking the third, according to its weight calculated with DANP is C_{31} (production lead time). The results of Dematel reveal that C_{31}, which is a cause criterion, is significant as it has the highest D_i+R_j value. Production lead time clearly affects other criteria and serves a significant function in determining suitable DP. Production lead time, consisting of all production and set-up time, is important in choosing a supply chain strategy.

Among these criteria, decision makers ranked C_{11} (predictability of demand), C_{12} (delivery reliability) and C_{14} (order size) as the least important. Although weights of all these criteria change according to the industry, firm or product type, decision makers in this study considered that these three criteria are not as significant as the others in determining suitable DP for the subject product family. Fuzzy Dematel results of D_i+R_j values of C_{11} and C_{12} reveal that they are the least important criteria. In other words, the results of DANP meet the expectations of the decision makers.

5. Conclusions

Changing market conditions, improvement in production technologies, and increase in customer expectations have compelled organizations to choose alternative strategies for the products produced for the markets with different features instead of using a one-size fits all strategy for all products in order to increase competitiveness and market share.

The purpose of this study is to calculate the weights of criteria effective in determining the position of DP for leagile supply chain strategy proposed to be matched for one of the product families, which is not functional or innovative, of a furniture components manufacturing firm.

A two-stage decision making method was used in calculating criteria weights. The first stage analyzed the interactions between dimensions and criteria under these dimensions using the Dematel method in a fuzzy environment. Significance levels of the criteria were determined, the dimensions and criteria were handled in terms of cause and effect groups, and causal diagram was obtained. Moreover, matrix T, which was used in DANP method, was calculated by the fuzzy Dematel method. In the second stage, weights of criteria were calculated by DANP method.

D_i+R_j values obtained from the fuzzy Dematel method used for dimensions revealed that product is the most important and market dimension is the least important among the three dimensions. According to D_i-R_j values, market dimension is classified under the cause group as its D_i-R_j value is positive (2,252). Also, the fact that this dimension has the highest D_i-R_j value displays its direct effect on other criteria. Following this, interactions and relations among all criteria were analyzed. Among the cause group criteria, predictability of demand has the highest D_i-R_j value (0,366). As this criterion affects other criteria in all the system more than it is affected by them, improving it which means minimizing the deviations in the predictability of demand will contribute progress of the system as a whole. Among effect group criteria, C_{31} (production lead time) is the net receiver criterion and is important within this group with its highest D_i+R_j. With DANP method used in the second stage of the study, weights of criteria influential in determining DP position were calculated and backorder cost ranked the first as it has the highest significance with 13,2 %.

This study provides a pathway for the firms who want to use leagile supply chain strategy in determining the DP where they make-to-stock as generic form and from which point forwards they should be make-to-order by differentiating the product. Moreover, it is expected to give insights for the academics studying this topic and decision makers working in all sectors.

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