Barriers of the Supply Chain Integration Process

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Abstract Complex systems of supply chains need to be integrated. Such integration is essential in order to achieve sustainable logistics of the system. This chapter presents an approach to this issue based on DEMATEL methodology. This chapter presents an approach to this issue based on identifying the barriers in supply chain integration and understanding their cause effect relationships using the DEcision MAking Trial and Evaluation Laboratory (DEMATEL) methodology. A total of 17 barriers affecting the integration of business entities in the supply chain were identified through a survey addressed to experts from Poland and Canada. The results of the study show Lack of Resource sharing (integration), Lack of Organisational compatibility, Lack of Information sharing, Lack of Responsibility sharing, and Lack of Planning of supply chain activities as top five barriers in supply chain integration. Therefore, organizations should investigate causes behind these barriers and take appropriate measures to resolve them to ensure seamless integration across their supply chains.

Keywords Supply chain · Integration · Barriers · DEMATEL · Cause effect relationship · Impact analysis

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1 Introduction

Supply chain is metastructure (metasystem), characterised by a dynamic holarchy constituted of holons (business organisations) cooperating with each other. Business entities join in the supply chain by providing a diverse and unique ability or skill; this ability or skill is their characteristics. The more the supply chain expands, the less consistent and intimate the created system becomes; consequently lack of integration occurs. This results in the internal links and relationships becoming less stable; the cooperation between the entities might be then hindered.

The supply chain consists of permanent links, which constitute its core, and dynamically modified licks, for example, appropriate for a specific task. They are referred to as joining links. Following the completion of a given task, the joining links are separated from the core of the supply chain and the co-operation is discontinued (Awasthi et al. 2014; Grzybowska 2010a, b). A supply chain is a network of organisations which are involved in different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer (Christopher 1998). The Supply Chain is a concept designed to manage entire supply chains consisting of numerous participating organisations (Mentzer et al. 2001). Supply chain management (SCM) plays an important role on increasing productivity of any organization and there is an increasing interest on implementing efficient SCM techniques in the competitive environment (Zandin and Maynard 2001). In order to develop supply chains (sustainable supply chains), all the involved organizations should work cohesively and constructively towards the bigger goal of achieving the triple bottom line objectives (economic, environment, social) of sustainability (Awasthi et al. 2014; Bai et al. 2012; Elkington 1994; Seuring 2013; Seuring and Müller 2008).

In 1995, R. Ganeshan, T. P. Harrison and D. Brown, S. Wilson and H. L. Lee, C. Billington defined the supply chain as a network of places (Brown and Wilson 2005; Ganeshan and Harrison 1995; Lee and Billington 1995). In the opinion of B. M. Lambert, J. R. Stock and L. M. Ellram, the supply chain should be organized so that the enterprises therein involved adjust to the flow and changes the supply chain undergoes (Lambert et al. 1998).

In order to discuss the supply chain, a list of items understood as factors or characteristics which determine the establishment of a supply chain has been created. It is a typical list of constitutive elements also allowing for the identification of significantly different supply chains (Grzybowska 2010a). The first listed element is the size of the supply chain (1). Even just two entities might constitute a basic supply chain as they fulfil all the constitutive elements of the supply chain. The previous research, however, suggests that for the supply chain to be discussed three cooperating cells need to be identified. The entities constituting the chain perform their designated roles (2). These roles are usually determined in accordance with the specific tasks roles. These roles commonly complement each other and reflect the existing relationships between the entities. The entities in the supply

chain are also connected by business connections and relationships. These relationships are established during the contacts which occur due to the roles the entities fulfil, as well as the company status (3). The quality of the contact between the entities affects the integrity of the supply chain they constitute (4). Another constitutive element of the supply chain is communication (5), which may be also understood as coordination mechanisms essential to build a supply chain and maintain it. As a result of communication between the entities certain interactions take place (6), understood as the exchange of stimulus and responses to the business partner's activities. Interactions in the supply chain have varying degrees of intensity, complexity and length. Each supply chain is internally organised (7), the operations of business entities within this organised structure are more or less efficiently coordinated.

Between the entities functioning in the supply chain, the network of connections and relationships is established. The strength of the positive relations represents the level of integration (consistency). Integration (consistency) is one of the constitutive elements of the supply chain which depend on the quality of relationships between the entities constituting the supply chain as well as the size of the established system.

The analysis of degrees of consistency and organisation of the supply chain (integration), as well as the relationships result from it, has allowed to create two concepts (strategies) of how the entities are included in the supply chain. Integration is understood here as the degree of unification of the entities or else the stage of separate units becoming a whole. Depending on the selected strategy of cooperation between the enterprises functioning in the supply chain the approach to consistency of the supply chain is modified.

The first concept concerns full integration of the entity in the supply chain. The concept stems from the total commitment of the company in one organisational system of the supply chain and results from the complete symbiosis. Full integration involves close cooperation of enterprises in the supply chain; this cooperation is beneficial for the engaged links. When there is close integration and symbiosis the benefits can be mutual. In some cases, integration is so deep that both sides become dependent; at the same time, however, it ensures the enterprise survival in a changing and dynamic market. In biology such a strategy is called mutualism.

A looser form of still symbiotic cooperation is protocooperation. It's free integration which brings benefits to both parties but unlike mutualism it leaves the entities independent. In protcooperation the entities interact periodically. Both forms, mutualism and protocooperation, are typical examples of business interactions characterised by non-antagonistic relations where the parties remain friendly and non-competing.

The advantages of cooperation based on the concept of full integration may also be one-sided. Should that occur, the benefits of cooperation are enjoyed by one side only, although the other side is not harmed. Thus solution can be referred to as commensalism where the "+/0" interaction can be observed and one of the

business partners generates benefits when the other does not make a loss but does not achieve benefits either.

Full integration of the supply chain is linked closely with one system. It may result from extremely specialised production/service activity in the supply chain (e.g., support activity) or be associated with the performed role of roles (e.g., leader or manufacturer). Full integration of the entity with the supply chain can also result from entity's resources being insufficient to join in and become integrated in some other supply chains. However, should the company decide to invest in new resources and increase their abilities, it may be that within the existing supply chain the entire business entity is not needed nor wanted. In this case, the company should get involved in other business arrangements and accept new tasks to ensure continuous development.

The model of full integration of an entity in the supply chain is characterised by a greater integrity. This strategy is more likely to be implemented in the case of small structures and supply chains with an innovative character. The greater the supply chain, the lower level of integration. This is due to the high number of cooperating organisations and low level of coordination of their operations.

The concept of partial inclusion in the supply chain assumes that only fragments of the entities constitute the chain. They are involved in a range of operations in other more or less integrated supply chains, with varied levels of engagement. Given link is involved in several independent/different supply chains. Their relationship, degree of contact intensity, type of bond and degree of integration affects the way they operate and the activities they undertake.

The openness of this type of supply chains makes them susceptible to all sorts of inputs and changes, including replacement of the chain links. In this case, however, restrictions on the entities are put in place, for example, ensuring they refrain from getting involved in a competitive supply chain. Therefore, despite common elements of these systems, certain clear limits of the supply chains exist.

2 Barriers of the Integration

A survey conducted among experts researching the supply chains, identified 17 factors affecting the integration of the supply chain type systems. They are listed in Table 1. In this survey the respondents were asked to indicate the importance of 17 listed enablers on a five-point Likert scale. On this scale, 1 and 5 correspond to 'very low importance' to 'very high importance', respectively. In total, questionnaires were sent to 20 experts in Poland and Canada. All of them were analysed.

Table 1 Factors affecting the integration of the supply chain

No.	Factors
1	Information sharing
2	Coordination
3	Trust
4	Willingness to collaborate
5	Communication
6	Common business goals
7	Responsibility sharing
8	Planning of supply chain activities
9	Flexibility
10	Benefit sharing
11	Joint decision making
12	Organizational culture
13	Organisational compatibility
14	Resource sharing (integration)
15	Top management support
16	Technological readiness
17	Training

3 The DEMATEL Methodology

Decision Making and Trial Evaluation Laboratory (DEMATEL) was developed in the belief that the appropriate use of scientific research methods could improve understanding of the specific problem. The Science and Human Affairs Program of the Battelle Memorial Institute of Geneva developed it between 1972 and 1976 to study and resolve the complicated and intertwined problem group (Tzeng et al. 2007; Wu and Lee 2007). DEMATEL is a sophisticated method for establishing a structural model involving causal relationships among complex factors (Gabus and Fontela 1972, 1973). One of the group decision-making methods is decision-making trial and evaluation laboratory (DEMATEL) method, which uses matrices and diagrams for visualizing the structure of complicated causal relationships (Fontela and Gabus 1976). DEMATEL was applied to solve problems concerning decisions in order to clarify the essential features of the problems and help make countermeasures. Tzeng et al. (2007) and Liou et al. (2007) used the fundamentals of this method to transform the attributes of the application and evaluation into a non-independent multi-criteria evaluation of problems. DEMATEL then determines the interdependent and constraining relations based on the specific features of the subjects. In this way, it reflects the essential features and the evolving trend of the system.

This technique is widely used in solving complex problems (Hori and Shimizu 1999; Huang et al. 2007; Lin and Wu 2008; Lin and Tzeng 2009; Liou et al. 2008; Seyed Hosseini et al. 2006; Tsai and Chou 2009; Tzeng et al. 2007; Wu 2008; Wu and Lee 2007) such as user interface (Hori and Shimizu 1999), e-learning evaluation (Tzeng et al. 2007), developing global managers' competencies (Wu and Lee 2007),

reprioritization of failures in analyzing FMEA system (Seyed Hosseini et al. 2006), the innovation policy portfolios for Taiwan's SIP mall Industry (Huang et al. 2007), selection of knowledge management strategy (Wu 2008), causal analytic method for group decision making (Lin and Tzeng 2009), airlines safety measurement (Liou et al. 2008), and finally selection management systems (SMEs) (Tsai and Chou 2009).

DEMATEL is a popularly used method to model the relationship between variables. It is based on digraphs which separate the involved variables into two groups—cause and effect. A basic contextual relation among elements is portrayed where values represent the strength of influence. The various steps of DEMATEL are presented as follows:

1. Generate the direct relation matrix
   The direct relationship matrix represents the aggregate influence scores for various variables over each other obtained from expert ratings on a scale of 0 to 4 where the notations are: 0 (No influence), 1 (somewhat influence), 2 (medium influence), 3 (high influence), and 4 (very high influence).
   Let A represent the $n \times n$ matrix obtained by pairwise comparisons in terms of influences and directions between variables where a_{ij} represents the degree to which variable i affects variable j i.e. $A = \lfloor a_{ij} \rfloor_{n \times n}$
2. Normalize the direct relation matrix
   The normalized direct relation matrix is obtained from direct relation matrix as follows

$$B = \left[b_{ij}\right]_{n \times n} = \frac{A}{\max_{1 \le i \le n} \sum_{j=1}^{n} a_{ij}}, \text{where } 0 \le b_{ij} \le 1 \tag{1}$$

   and the principal diagonal elements of B are all equal to zero.
3. Develop the total relation matrix
   The total relation matrix is obtained from normalized direct relation matrix using the following equation

$$C = \left[c_{ij}\right]_{n \times n} = B(I - B)^{-1} \tag{2}$$

   where I is the identity matrix.
4. Produce a causal diagram
   The sum of the rows and the sum of columns are denoted by vectors D and E.

$$D = \left[d_{ij}\right]_{n \times 1} = \left[\sum_{j=1}^{n} e_{ij}\right]_{n \times 1} \tag{3}$$

$$E = \left[e_{ij}\right]_{1 \times n} = \left[\sum_{i=1}^{n} e_{ij}\right]_{1 \times n} \tag{4}$$

Table 2 List of Barriers

C1	Lack of trust
C2	Lack of coordination
C3	Lack of communication
C4	Lack of information sharing
C5	Lack of planning of supply chain activities
C6	Lack of top management support
C7	Lack of organisational compatibility
C8	Lack of flexibility
C9	Lack of benefit sharing
C10	Lack of joint decision making
C11	Lack of resource sharing (integration)
C12	Lack of responsibility sharing
C13	Lack of technological readiness
C14	Lack of common business goals
C15	Lack of willingness to collaborate
C16	Lack of organizational culture
C17	Lack of training

The horizontal axis (D + E) represents the importance of the variables whereas the vertical axis (D − E) shows the cause and effect relationships. The variables with positive (D − E) values are the cause factors whereas those with negative are effect factors.

5. Depict structural relation between variables
   The structural relation amongst variables is shown through an inner dependence matrix by retaining only those variables whose effect in the matrix C is greater than the threshold value. The threshold value δ can be given by the experts, based on literature review or obtained by averaging the values of C matrix elements.

4 Empirical Analysis: Discussion

In this section, we present the application of DEMATEL technique to identify the relationship between various barriers (Table 2) of supply chain integration considered in this study.

To assess the degree of influence and relationship of various barriers with each other, we performed literature review and discussed with experts from academia. Table 3 presents the direct relation matrix containing influence and relationship of various barriers with each other. The ratings are provided on a scale of 0 to 4 where the notations are 0 (No influence), 1 (somewhat influence), 2 (medium influence), 3 (high influence), and 4 (very high influence).

Table 4 shows the normalized relation matrix for the barriers obtained using Eq. 1.

Table 3 Direct relation matrix for barriers

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
C1	0	2	0	3	0	3	4	0	2	4	4	0	0	0	2	2	1
C2	0	0	4	2	4	2	4	4	0	0	3	4	1	0	3	2	2
C3	1	3	0	2	4	2	4	1	2	3	4	3	4	0	2	2	4
C4	4	4	4	0	3	2	4	0	0	3	4	4	2	2	3	2	4
C5	1	3	3	3	0	2	4	4	0	3	3	2	2	2	3	2	1
C6	2	2	2	2	2	0	1	1	2	2	2	2	1	1	2	1	2
C7	2	3	2	2	3	2	0	2	2	3	4	2	4	2	1	1	0
C8	1	2	2	2	2	1	4	0	0	0	2	2	1	1	1	1	2
C9	1	2	2	2	2	2	4	2	0	4	3	2	0	1	2	1	0
C10	1	1	2	2	2	2	4	1	1	0	4	2	0	2	1	1	2
C11	3	3	3	3	3	2	2	2	2	3	0	3	4	2	3	3	3
C12	2	3	2	3	3	4	4	2	4	4	3	0	2	2	3	2	2
C13	2	2	2	2	2	1	1	2	2	2	2	2	0	2	1	2	0
C14	2	2	2	2	2	1	4	0	0	2	1	4	0	0	1	1	2
C15	2	3	3	3	4	1	4	0	4	4	2	2	0	3	0	1	2
C16	2	2	2	2	2	0	4	1	2	2	2	2	0	2	1	0	2
C17	2	1	1	2	2	1	1	1	2	2	1	1	1	1	1	1	0

Table 5 depicts the total relation matrix obtained using Eq. 2.

Table 6 shows the D and E vectors obtained using Eqs. 3–4 to develop the causal diagram.

Table 7 shows the various barriers in decreasing order of their impacts (D + E). It can be seen that the top 5 barriers are Lack of Resource sharing (integration), Lack of Organisational compatibility, Lack of Information sharing, Lack of Responsibility sharing and Lack of Planning of supply chain activities. Organizations should focus on eliminating these barriers in particular to achieve integration. The barrier with least impact is lack of flexibility.

Table 8 shows the barriers organized in terms of their relationships (D−E). The *+ive* ones are the causes while the *–ive* ones are the effects. It can be seen in Table 7 that Lack of Information sharing, Lack of Willingness to collaborate, Lack of Responsibility sharing, Lack of Benefit sharing, Lack of Communication, Lack of Common business goals, Lack of Organizational culture, Lack of Technological readiness and Lack of Flexibility are the cause variables (barriers) which affect remaining other barriers.

Figure 1 shows the impact relationship map for the 17 barriers based on their impact (D + E) and relationship (D−E) values. It can be seen that C11, C7, C4, C12 and C5 are the barriers with highest impact. The cause variables are present in the upper half of the graph and have D − E value >0. The effect variables are present in the lower half and have D − E value <0.

Since C11 (Lack of resource sharing) is the barrier with most impact, we will develop inner dependency matrix to identify the causes/effects barriers that affect it. The threshold value δ is obtained by averaging the values of Total relation matrix (Table 5) and is equal to 0.1759. The inner dependency matrix is shown in

Table 4 Normalized direct relation matrix for barriers

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
C1	0	0.044	0	0.067	0	0.067	0.089	0	0.044	0.089	0.089	0	0	0	0.044	0.044	0.022
C2	0	0	0.089	0.044	0.089	0.044	0.089	0.089	0	0	0.067	0.089	0.022	0	0.067	0.044	0.044
C3	0.022	0.067	0	0.044	0.089	0.044	0.89	0.022	0.044	0.067	0.089	0.067	0.089	0	0.044	0.044	0.089
C4	0.089	0.089	0.089	0	0.067	0.044	0.89	0	0	0.067	0.089	0.089	0.044	0.044	0.067	0.044	0.089
C5	0.022	0.067	0.067	0.067	0	0.044	0.89	0.089	0	0.067	0.067	0.044	0.044	0.044	0.067	0.044	0.022
C6	0.044	0.044	0.044	0.044	0.044	0	0.022	0.022	0.044	0.044	0.044	0.044	0.022	0.022	0.044	0.022	0.044
C7	0.044	0.0677	0.044	0.044	0.067	0.044	0	0.044	0.044	0.067	0.089	0.044	0.089	0.044	0.022	0.022	0
C8	0.022	0.044	0.044	0.044	0.044	0.022	0.089	0	0	0	0.044	0.044	0.022	0.022	0.022	0.022	0.044
C9	0.022	0.044	0.044	0.044	0.044	0.044	0.089	0.044	0	0.089	0.067	0.044	0	0.022	0.044	0.022	0
C10	0.022	0.022	0.044	0.044	0.044	0.044	0.089	0.022	0.022	0	0.089	0.044	0	0.044	0.022	0.022	0.044
C11	0.067	0.067	0.67	0.067	0.67	0.044	0.044	0.044	0.044	0.067	0	0.067	0.089	0.044	0.067	0.067	0.067
C12	0.044	0.067	0.044	0.067	0.067	0.089	0.089	0.044	0.089	0.089	0.067	0	0.044	0.044	0.067	0.044	0.044
C13	0.044	0.044	0.044	0.044	0.044	0.022	0.022	0.044	0.044	0.044	0.044	0.044	0	0.044	0.022	0.044	0
C14	0.044	0.044	0.044	0.044	0.044	0.022	0.089	0	0	0.044	0.022	0.089	0	0	0.022	0.022	0.044
C15	0.044	0.067	0.067	0.067	0.089	0.022	0.089	0	0.089	0.089	0.044	0.044	0	0.067	0	0.022	0.044
C16	0.044	0.044	0.044	0.044	0.044	0	0.089	0.022	0.044	0.044	0.044	0.044	0	0.044	0.022	0	0.044
C17	0.044	0.022	0.022	0.044	0.044	0.022	0.022	0.022	0.044	0.044	0.022	0.022	0.022	0.022	0.022	0.022	0

Table 5 Total relation matrix for barriers

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
C1	0.096	0.169	0.124	0.184	0.136	0.159	0.251	0.080	0.126	0.220	0.235	0.124	0.085	0.081	0.145	0.127	0.119
C2	0.124	0.173	0.247	0.205	0.267	0.170	0.308	0.196	0.114	0.180	0.259	0.246	0.142	0.106	0.200	0.156	0.174
C3	0.160	0.251	0.181	0.224	0.284	0.186	0.330	0.148	0.168	0.263	0.303	0.244	0.212	0.119	0.195	0.170	0.225
C4	0.236	0.292	0.281	0.201	0.285	0.203	0.360	0.135	0.142	0.287	0.328	0.283	0.184	0.170	0.232	0.184	0.244
C5	0.151	0.241	0.234	0.232	0.190	0.175	0.320	0.197	0.115	0.247	0.270	0.216	0.163	0.152	0.204	0.161	0.160
C6	0.135	0.169	0.163	0.164	0.177	0.097	0.192	0.103	0.126	0.179	0.191	0.164	0.104	0.099	0.146	0.107	0.140
C7	0.161	0.226	0.200	0.199	0.235	0.167	0.217	0.150	0.146	0.234	0.274	0.202	0.193	0.143	0.154	0.133	0.125
C8	0.107	0.160	0.153	0.153	0.167	0.110	0.236	0.076	0.076	0.123	0.178	0.154	0.104	0.092	0.115	0.099	0.131
C9	0.126	0.187	0.181	0.180	0.196	0.153	0.277	0.135	0.093	0.236	0.234	0.182	0.099	0.111	0.158	0.117	0.111
C10	0.122	0.157	0.170	0.171	0.185	0.145	0.260	0.107	0.109	0.143	0.240	0.172	0.095	0.125	0.130	0.111	0.146
C11	0.208	0.261	0.252	0.253	0.273	0.193	0.309	0.169	0.173	0.274	0.232	0.254	0.212	0.165	0.222	0.196	0.215
C12	0.191	0.267	0.238	0.258	0.279	0.239	0.356	0.174	0.217	0.301	0.302	0.197	0.176	0.169	0.227	0.178	0.197
C13	0.134	0.170	0.164	0.164	0.176	0.118	0.195	0.124	0.123	0.177	0.191	0.166	0.082	0.120	0.124	0.128	0.099
C14	0.135	0.169	0.161	0.163	0.176	0.121	0.252	0.082	0.085	0.178	0.171	0.204	0.087	0.077	0.124	0.106	0.139
C15	0.171	0.242	0.234	0.233	0.273	0.159	0.325	0.117	0.197	0.276	0.254	0.216	0.120	0.172	0.144	0.140	0.178
C16	0.139	0.175	0.168	0.169	0.182	0.102	0.262	0.107	0.128	0.184	0.199	0.170	0.090	0.123	0.128	0.088	0.142
C17	0.114	0.119	0.114	0.136	0.144	0.096	0.153	0.083	0.105	0.147674	0.137258	0.115184	0.08416	0.081605	0.100643	0.086896	0.074

Table 6 Total cause and effect for barriers

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
D	2.470	3.275	3.671	4.058	3.435	2.463	3.166	2.241	2.784	2.596	3.872	3.974	2.463	2.438	3.460	2.562	1.895
E	2.518	3.437	3.273	3.295	3.633	2.602	4.610	2.191	2.251	3.657	4.005	3.318	2.242	2.112	2.757	2.294	2.626
D + E	4.988	6.712	6.945	7.354	7.069	5.065	7.776	4.433	5.035	6.253	7.877	7.292	4.705	4.550	6.218	4.857	4.521
D – E	−0.048	−0.162	0.398	0.762	−0.198	−0.138	−1.44	0.050	0.533	−1.061	−0.133	0.655	0.220	0.325	0.702	0.267	−0.731

Table 7 Impact table

Barrier	ID	D + E
Lack of resource sharing (integration)	C11	7.877
Lack of organisational compatibility	C7	7.776
Lack of information sharing	C4	7.354
Lack of responsibility sharing	C12	7.292
Lack of planning of supply chain activities	C5	7.069
Lack of communication	C3	6.945
Lack of coordination	C2	6.712
Lack of joint decision making	C10	6.253
Lack of willingness to collaborate	C15	6.218
Lack of top management support	C6	5.065
Lack of benefit sharing	C9	5.035
Lack of trust	C1	4.988
Lack of organizational culture	C16	4.857
Lack of technological readiness	C13	4.705
Lack of common business goals	C14	4.550
Lack of training	C17	4.521
Lack of flexibility	C8	4.433

Table 8 Relationship table

Barrier	ID	D−E
Lack of information sharing	C4	0.762
Lack of willingness to collaborate	C15	0.702
Lack of responsibility sharing	C12	0.655
Lack of benefit sharing	C9	0.533
Lack of communication	C3	0.398
Lack of common business goals	C14	0.325
Lack of organizational culture	C16	0.267
Lack of technological readiness	C13	0.220
Lack of flexibility	C8	0.050
Lack of trust	C1	−0.048
Lack of resource sharing (integration)	C11	−0.133
Lack of top management support	C6	−0.138
Lack of coordination	C2	−0.162
Lack of planning of supply chain activities	C5	−0.198
Lack of training	C17	−0.731
Lack of joint decision making	C10	−1.061
Lack of organisational compatibility	C7	−1.443

Table 9. It contains Table 5 elements whose value exceeds δ. Looking at C11, we find that it is impacted by all barriers but except C14 and C17. Therefore, these barriers act as control barriers for C11 and should be carefully monitored. The impact values is highest for C4 (Lack of Information sharing), C3 (Lack of Communication) and C12 (Lack of Responsibility sharing).

Table 9 Inner dependence matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
C1				0.184			0.251			0.220	0.235						
C2			0.247	0.205	0.267		0.308	0.196		0.180	0.259	0.246			0.200		
C3		0.251	0.181	0.224	0.284	0.186	0.33			0.263	0.303	0.244	0.212		0.195		0.225
C4	0.236	0.292	0.281	0.201	0.285	0.203	0.360			0.287	0.328	0.283	0.184		0.232	0.184	
C5		0.241	0.234	0.232	0.190		0.320	0.197		0.247	0.270	0.216			0.204		
C6					0.177		0.192			0.179	0.191						
C7		0.226	0.200	0.199	0.235		0.217			0.234	0.274	0.202	0.193				
C8							0.236				0.178						
C9		0.187	0.181	0.180	0.196		0.277			0.236	0.234	0.182					
C10					0.185		0.260				0.240						
C11	0.208	0.261	0.252	0.253	0.273	0.193	0.309			0.274	0.232	0.254	0.212		0.222	0.196	0.215
C12		0.267	0.238	0.258	0.279	0.239	0.356		0.217	0.301	0.302	0.197	0.176		0.227	0.178	0.197
C13					0.176		0.195			0.177	0.191						
C14					0.176		0.252			0.178		0.204					
C15		0.242	0.234	0.233	0.273		0.325		0.197	0.276	0.254	0.216					0.178
C16					0.182		0.262			0.184	0.199						
C17																	

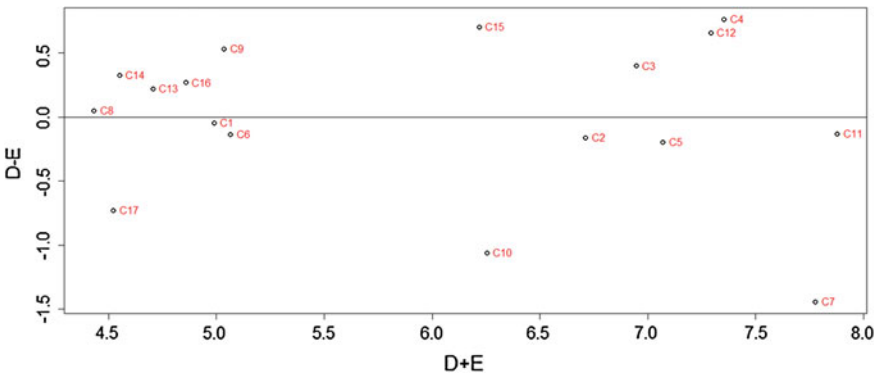

Fig. 1 Impact-relationship map

5 Managerial Implications

The results of our DEMATEL study show Lack of Resource sharing (integration), Lack of Organisational compatibility, Lack of Information sharing, Lack of Responsibility sharing, and Lack of Planning of supply chain activities as top five barriers in supply chain integration. Therefore, managers of interested organizations can look into causes behind these barriers and take appropriate measures to resolve them to ensure seamless integration across their supply chains.

6 Conclusions

In this chapter, we presented the barriers in supply chain integration and investigated their importance and causal relationships using Decision Making and Trial Evaluation Laboratory. The results of our DEMATEL study show Lack of Resource sharing (integration), Lack of Organisational compatibility, Lack of Information sharing, Lack of Responsibility sharing, and Lack of Planning of supply chain activities as top five barriers in supply chain integration.

The next step of our work involves identifying and evaluating alternatives using multicriteria decision making approaches to address the proposed barriers for efficient supply chain integration.

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