Development of a Decision Support System for Leagility Assessment in Fuzzy Environment

Chhabi Ram Matawale[a], Dr. Saurav Datta[b*], Prof. Siba Sankar Mahapatra[c]

[a,b,c] Department of Mechanical Engineering
National Institute of Technology, Rourkela-769008, INDIA
[*]Communicating Author (Email: *sdattaju@gmail.com*)

Abstract

Lean and agile concepts gained vital importance during the past few decades. For successful survival in the competitive global marketplace; the industrial sectors, throughout the world, are upgrading existing business strategies by adapting these concepts to achieve competitive advantage. The concept of 'leagility' has been emerged encapsulating salient features of 'leanness' as well as 'agility'. Leagility metric is difficult to achieve due to existence of imprecise, vague information associated with evaluation criterions. In order to tackle such inconsistency- and incompleteness in the decision-making process; present work proposes a leagility evaluation model in fuzzy environment. A structured model consisting of leagile capabilities as well as attributes has been explored to assess an overall leagility index. The appraisement model has been implemented in a case application and, the data, obtained thereof, has been analyzed. Future opportunities towards improving leagility degree have also been identified.

Keywords: Leagility, leanness, agility

1. Introduction and State of Art

Lean manufacturing focuses on cost reduction by eliminating non-value added activities, so that several advantages can be obtained such as minimization/elimination of waste, increased business opportunities and high competitive advantage. Lean manufacturing is adopted where there is a stable demand and to ensure a level schedule. The term 'lean manufacturing', which first appeared in 1990 [1-2]; it was used to refer to the elimination of waste in the production process, has been announced as the production system of the 21st century.

Agile manufacturing is the ability to respond and create new windows of opportunity in a turbulent market environment, driven by the individualization of customers' requirements cost effectively, rapidly and continuously. Agile manufacturing is essentially the utilization of market knowledge and virtual corporation to exploit profitable opportunities in a volatile marketplace [3-5].

Leagility is the combination of the lean and agile paradigms within a supply chain strategy by positioning the decoupling point. A leagile system has the characteristics of both lean and agile systems, acting together in order to exploit market opportunities in a cost-efficient manner. The system, named as leagile, could be an entire supply chain or a single manufacturing plant with individual lean and agile sub groups containing a decoupling point, which separates the lean and agile portions of the system. The decoupling point is the point in the material flow streams to which the customer's order penetrates [6-8].

In this era of globalization, modern manufacturing enterprises are continuously facing tough market competitions. The remarkable industrial growth in past few decades has completely revolutionized their traditional manufacturing strategies, giving emergence to the modern concepts of lean, agile, and nowadays, leagile manufacturing. These new strategies enable the enterprises to survive in the turbulent environment of violent competitions laid down by their competitors. Recent advancements have shown that leagile principle has immense potential to counteract the existing complexity of the market scenario. Therefore, leagile principles are, nowadays, attracting the manufacturing enterprises, and researchers are aiming to find its prominent benefits in all industrial sectors.

Agarwal et al. [9] presented an ANP based framework, encapsulated the market sensitiveness, process integration, information driver and flexibility measures of supply chain performance. The paper explored the relationship among lead-time, cost, quality, and service level and the leanness as well as agility of a case supply chain in fast moving consumer goods business. Soni and Kodali [10] attempted to develop a multi-attribute decision model: the Performance Value Analysis (PVA) to justify the philosophy of the Leagile Supply Chain (LASC).

The extent of leagility is difficult to estimate due to involvement of subjective evaluation criteria/attributes. Leagile enablers/ capabilities, attributes as well as criterions contribute to the overall leagility degree. However, it is difficult to assess leagility due to subjectivity of the evaluation indices (criteria/attributes); these are qualitative in nature. Therefore, assessment of leagility relies on decision-makers' personal judgment which invites ambiguity and imprecision in decision-making. Fuzzy logic has the capability of dealing with such inconsistent vague information and facilitates decision-modelling [11]. To this end, present paper highlights a fuzzy based decision support system of leagility estimation in supply chain.

2. Fuzzy Based Leagility Assessment Module: Case Application

Present study on leagility evaluation has been attempted by the procedural framework described as follows. A model (Table 1) has been adapted for supply chain leagility appraisement and implemented as a case study in an Indian famous automobile manufacturing industry at eastern part of India. The results obtained thereof have been analyzed and interpreted from managerial viewpoint. This has been illustrated as follows.

2.1 Determination of the appropriate linguistic scale for assessing performance ratings and importance weights of leagile indices

The linguistic terms have been used to assess the performance ratings and priority weights of various leagile indices. In order to assess performance rating of various leagile attributes, the nine linguistic variables {***Absolutely Poor (AP), Very Poor (VP), Poor (P), Medium Poor (MP), Medium (M), Medium Good (MG), Good (G), Very Good (VG) and Absolutely Good (AG)***} have been used. In order to assess importance weight (priority degree) of leagile capabilities/attributes, the following linguistic variables {***Absolutely Low (AL), Very Low (VL), Low (L), Medium Low (ML), Medium (M), Medium High (MH), High (H), Very High (VH), Absolutely High (AH)***} have been utilized. The linguistic variables (Table 2) have been accepted among the Decision-Makers (DMs) of the enterprise taking into consideration the company policy, company characteristics, business changes and competitive situation.

2.2 Collection of decision-making information using linguistic terms

After aforesaid linguistic variables for assessing performance ratings and importance weights of leagile indices has been accepted by the decision-makers (DMs), the decision-makers have been instructed to use aforesaid linguistic scales to assign importance weights for leagile capabilities as well as related attributes (Table 3-4); and also to assess the performance rating against each leagile attributes (Table 5).

2.3 Approximation of linguistic judgment by fuzzy numbers

Using the concept of fuzzy logic, the linguistic variables have been approximated by generalized interval-valued trapezoidal fuzzy numbers [12-15]. Next, the aggregated decision-making cum evaluation matrix, which corresponds to the aggregated fuzzy rating against each leagile attribute (at level 2) with corresponding aggregated fuzzy weight, has been constructed. Computed fuzzy rating (using Eq. 1) and aggregated fuzzy priority weights for leagile capabilities (at level 1) have also been obtained. Decision-makers pulled opinion (average) has been considered for evaluating aggregated fuzzy rating as well as priority weights.

2.4 Determination of FPI

FPI represents *fuzzy performance index* of overall leagility. The fuzzy performance index has been calculated at the attribute level and then extended to enabler level. Fuzzy performance index at the attribute level encompasses several leagile attributes. The fuzzy index (rating) of 1st level leagile capabler can be calculated using the formula:

$$U_i = \frac{\sum\left(w_{ij} \otimes U_{ij}\right)}{\sum w_{ij}} \quad (1)$$

Here U_{ij} represents performance rating of j^{th} attribute C_{ij} under i^{th} leagile capability C_i and w_{ij} represents fuzzy weight corresponding to the said leagile attribute.

Overall Fuzzy Performance Index (FPI) can be calculated as:

$$U(FPI) = \frac{\sum w_i \otimes U_i}{\sum w_i} \quad (2)$$

Here U_i represents performance rating of i^{th} leagile capability C_i and w_i is the corresponding weight.

The value of FPI thus obtained is: [(0.48, 0.61, 1.046, 1.292; 0.8), (0.48, 0.61, 1.046, 1.292; 1.0)].

After evaluating FPI and supply chain existing leagility level extent, simultaneously it is also felt indeed necessary to identify and analyze the obstacles (called leagile barriers). Therefore, the aforesaid fuzzy leagility appraisement system has been extended to investigate on ill-performing areas which need future improvement.

Fuzzy Performance Importance Index (FPII) may be used to identify these ill-performing areas [16]. FPII combines the performance rating and importance weight of various 2nd level leagile attributes (Eq. 3-4). The higher the FPII of a factor, the higher is the contribution.

$$FPII_{ij} = w'_{ij} \otimes U_{ij} \quad (3)$$

Here, $w'_{ij} = \left[\left[(1,1,1,1;1),(1,1,1,1;1)\right] - w_{ij}\right]$ (4)

U_{ij} is the appropriateness rating and w_{ij} is the importance weight of j_{th} attribute (under i_{th} 1st level leagile capability).

The concept of '*Degree of Similarity*' between two fuzzy numbers [14] has been adopted here for performance ranking of leagile attributes. The degree of similarity between *Ideal FPII* and *FPIIs* corresponding to each evaluation attribute has been computed. The particular attribute which corresponds to high degree of similarity (FPII of attribute as compared to Ideal FPII) is assumed to have high contribution; it indicates high performance and high ranking order). According to the descending order of the DOS values; the attributes ranking order has been determined.

3. Conclusion: Managerial Implication

Managerial decision-making process often experience uncertain-vague data which is really difficult to analyze. Fuzzy logic has the capability to overcome such imprecise linguistic human judgment. Fuzzy logic is an efficient tool to capture human perception to correlate with a mathematical base. Supply chain leagility, as a whole, is a conceptual philosophy difficult to model and to estimate an overall leagility index quantitatively. In this paper an effort has been made to establish a scientific mathematical background to assess overall leagility degree for a given supply chain and to assess the extent of successful performance of the key indices that stimulate leagility. The fuzzy based leagility

evaluation model presented here can be effectively implemented in industries supply chain to attain competitive advantage in the market.

4. References

[1] J.P. Womack, D.T. Jones, & D. Ross, The Machine That Changed the World, 1990.

[2] M. Holweg, The genealogy of lean production, *Journal of Operations Management*, 2007, Vol. 25, pp. 420–437.

[3] D.J. Power, A.S. Sohal, & S. Rahman, Critical success factors in agile supply chain management: An empirical study, *International Journal of Physical Distribution and Logistics Management*, 2001, Vol. 31, No. 4, pp. 247-265.

[4] H. Katayama, & D. Bennett, Agility, adaptability and leanness: A comparison of concepts and a study of practice, *International Journal of Production Economics*, 1999, Vol. 60-61, pp. 43-51.

[5] M. Christopher, The agile supply chain, competing in volatile markets, *Industrial Marketing Management*, 2000, Vol. 29, pp. 37-44.

[6] R. Mason-Jones, B. Naylor, & D.R. Towill, Engineering the leagile supply chain, *International Journal of Agile Management Systems*, 2000, Vol. 2, No. 1, pp. 54 – 61.

[7] R. Mason-Jones, B. Naylor, D.R. Towill, Lean, agile or leagile? Matching your supply chain to the marketplace, International Journal of Production Research, 2000, Vol. 38, No. 17, pp. 4061-4070.

[8] J. Prince, & J.M. Kay, Combining lean and agile characteristics: Creation of virtual groups by enhanced production flow analysis, *International Journal of Production Economics*, 2003, Vol. 85, pp. 305-318.

[9] A. Agarwal, R. Shankar, &. M.K. Tiwari, Modelling the metrics of lean, agile and leagile supply chain: An ANP-based approach, *European Journal of Operational Research*, 2006, Vol. 173, pp. 211–225.

[10] G. Soni, & R. Kodali, Performance value analysis for the justification of the leagile supply chain, *International Journal of Business Performance Management*, 2009, Vol. 11, No.1/2, pp. 96 - 133.

[11] S. Vinodh, & S. Aravindraj, Evaluation of leagility in supply chains using fuzzy logic approach, *International Journal of Production Research*, 2012, (Online Version) DOI:10.1080/00207543.2012.693960.

[12] W. Guijun, & L. Xiaoping, The applications of interval-valued fuzzy numbers and interval-distribution numbers, *Fuzzy Sets and Systems*, 1998, Vol. 98, No. 3, pp. 331–335.

[13] S.J. Chen, & S.M. Chen, Handling information filtering problems based on interval-valued fuzzy numbers, *Journal of the Chinese Institute of Engineers*, 2006, Vol. 29, No. 1, pp. 83–96.

[14] S.J. Chen, & S.M. Chen, Fuzzy risk analysis based on measures of similarity between interval-valued fuzzy numbers, *Computers and Mathematics with Applications*, 2008, Vol. 55, pp. 1670–1685.

[15] D.H. Hong, & S. Lee, Some algebraic properties and a distance measure for interval-valued fuzzy numbers, *Information Sciences*, 2002, Vol. 148, No. 1, pp. 1–10.

[16] S. Vinodh, & S.R. Devadasan, Twenty criteria based agility assessment using fuzzy logic approach, *International Journal of Advanced Manufacturing Technology*, 2011, Vol. 54, pp. 1219–1231.

Table 1: Leaglity Assessment Model [11]

Targeted Goal	Leagile enablers/capabilities (1^{st} level)	Leagile attributes (2^{nd} level)
Leagility (C)	Virtual Enterprises (C_1)	Virtual retail stores (C_{11})
		E- fulfillment logistics (C_{12})
		Outsourcing (C_{13})
		Integrated logistics management (C_{14})
		Internal SCM (C_{15})
		Supply chain partner selection (C_{16})
		Organizational structure (C_{17})
		Distributed virtual manufacturing (C_{18})
		Logistics management (C_{19})
		E-commerce (C_{110})
	Collaborative Relationships (C_2)	Enterprise wide relationship management (C_{21})
		Supplier relationship management (C_{22})
		Logistics service providers (C_{23})
		Collaborative planning, forecast and replenishment (C_{24})
		Collaborative order fulfillment visibility (C_{25})
	Strategic management (C_3)	Nature of management (C_{31})
		Inventory management (C_{32})
		Cycle time reduction (C_{33})
		Time management (C_{34})
		Development of new technology (C_{35})
		Process management (C_{36})
		Production planning (C_{37})
		Quality status (C_{38})
		Product design and service (C_{39})
		Manufacturing set up (C_{310})
		Human resources (C_{311})
		Vendor management (C_{312})
	Knowledge and IT management (C_4)	E- business (C_{41})
		Re-engineered working pattern (C_{42})
		Decentralization (C_{43})
		Supply chain visibility (C_{44})
		Equipment engineering system (EES) (C_{45})
		Information system (C_{46})
		Electronic data Interchange(EDI) (C_{47})
	Customer and Market Sensitiveness (C_5)	Customer focus (C_{51})
		Market sensitivity (C_{52})
		Culture and change management (C_{53})
		Product service level (C_{54})
		Mass customization (C_{55})
		Quality of product (C_{56})

Table 2: Definitions of linguistic variables (A-9 member linguistic term set)

Linguistic terms to be used for attribute rating	Linguistic terms to be used for assigning priority weights	Generalized interval-valued trapezoidal fuzzy numbers
Absolutely Poor (AP)	Absolutely Low (AL)	[(0, 0, 0, 0; 0.8), (0, 0, 0, 0; 1)]
Very Poor (VP)	Very Low (VL)	[(0, 0, 0.02, 0.07; 0.8), (0, 0, 0.02, 0.07; 1)]
Poor (P)	Low (L)	[(0.04, 0.10, 0.18, 0.23; 0.8), (0.04, 0.10, 0.18, 0.23; 1)]
Medium Poor (MP)	Medium Low (ML)	[(0.17, 0.22, 0.36, 0.42; 0.8), (0.17, 0.22, 0.36, 0.42; 1)]
Medium (M)	Medium (M)	[(0.32, 0.41, 0.58, 0.65; 0.8), (0.32, 0.41, 0.58, 0.65; 1)]
Medium Good (MG)	Medium High (MH)	[(0.58, 0.63, 0.80, 0.86; 0.8), (0.58, 0.63, 0.80, 0.86; 1)]
Good (G)	High (H)	[(0.72, 0.78, 0.92, 0.97; 0.8), (0.72, 0.78, 0.92, 0.97; 1)]
Very Good (VG)	Very High (VH)	[(0.93, 0.98, 1, 1; 0.8), (0.93, 0.98, 1, 1; 1)]
Absolutely Good (AG)	Absolutely High (AH)	[(1, 1, 1, 1; 0.8), (1, 1, 1, 1; 1)]

Table 3: Priority weight of leagile attributes (in linguistic scale) given by the DMs

Leagile attributes	Priority weight of leagile attributes (in linguistic scale) given by the DMs									
	DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9	DM10
C_{11}	VH	VH	MH	AH	H	H	H	MH	VH	AH
C_{12}	AH	AH	H	H	AH	AH	AH	H	H	H
C_{13}	H	MH	AH	VH	AH	MH	MH	AH	MH	H
C_{14}	VH	MH	MH	MH	H	AH	AH	MH	H	AH
C_{15}	MH	H	AH	H	VH	H	H	AH	H	MH
C_{16}	H	M	H	VH	MH	H	MH	H	VH	AH
C_{17}	H	AH	AH	VH	H	H	H	AH	H	H
C_{18}	AH	H	VH	AH	AH	H	AH	VH	H	H
C_{19}	MH	VH	H	H	MH	VH	MH	H	VH	H
C_{110}	AH	MH	H	VH	MH	H	AH	AH	H	H
C_{21}	H	H	VH	MH	H	H	H	MH	H	VH
C_{22}	H	H	H	H	M	H	AH	AH	H	H
C_{23}	H	VH	VH	AH	AH	H	VH	MH	VH	H
C_{24}	H	MH	MH	MH	H	AH	H	MH	H	VH
C_{25}	VH	VH	AH	AH	VH	MH	H	H	AH	H
C_{31}	H	AH	H	H	MH	AH	VH	M	MH	MH
C_{32}	H	MH	VH	H	H	MH	H	AH	AH	H
C_{33}	H	MH	MH	H	VH	H	VH	H	H	MH
C_{34}	VH	H	H	H	H	H	MH	VH	H	H
C_{35}	AH	M	H	VH	MH	VH	H	MH	H	AH
C_{36}	H	AH	MH	H	H	MH	AH	AH	H	MH
C_{37}	VH	AH	H	H	H	AH	MH	H	VH	AH
C_{38}	MH	H	AH	H	VH	MH	AH	VH	H	H
C_{39}	H	VH	MH	AH	H	MH	H	MH	H	AH
C_{310}	H	H	AH	H	H	H	VH	H	H	VH
C_{311}	VH	AH	H	VH	VH	M	MH	MH	VH	H
C_{312}	MH	MH	AH	VH	H	AH	H	H	H	H
C_{41}	VH	AH	VH	H	H	H	AH	AH	AH	VH
C_{42}	VH	H	H	MH	H	VH	H	MH	MH	H
C_{43}	H	H	H	H	VH	MH	VH	AH	AH	VH
C_{44}	MH	H	AH	MH	H	H	MH	H	H	MH
C_{45}	H	H	H	H	H	H	H	AH	H	H
C_{46}	H	VH	VH	AH	VH	VH	H	VH	H	AH
C_{47}	VH	H	MH	MH	H	VH	VH	H	H	MH
C_{51}	H	VH	MH	MH	AH	H	H	H	VH	VH
C_{52}	AH	H	MH	VH	VH	VH	H	VH	MH	AH
C_{53}	H	H	H	H	VH	MH	AH	H	MH	H
C_{54}	VH	VH	M	AH	H	MH	H	H	H	VH
C_{55}	VH	VH	AH	H	H	H	AH	H	VH	MH
C_{56}	H	H	MH	VH	VH	M	MH	AH	H	MH

Table 4: Priority weight of leagile enablers (in linguistic scale) given by the DMs

Leagile enablers	Priority weight of leagile enablers (in linguistic scale) given by the DMs									
	DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9	DM10
C_1	H	AH	MH	VH	VH	H	AH	AH	VH	MH
C_2	VH	H	AH	AH	H	VH	VH	VH	MH	AH
C_3	MH	AH	AH	H	VH	AH	MH	H	VH	H
C_4	H	VH	MH	AH	MH	AH	H	VH	H	AH
C_5	AH	MH	H	H	VH	MH	VH	MH	AH	MH

Table 5: Performance rating of leagile attributes (in linguistic scale) given by the DMs

Leagile attributes	Performance rating of leagile attributes (in linguistic scale) given by the DMs									
	DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9	DM10
C_{11}	G	VG	M	AG	G	AG	M	VG	VG	G
C_{12}	MG	G	VG	G	VG	G	VG	AG	G	MG
C_{13}	M	G	G	MG	G	VG	G	G	VG	MG
C_{14}	G	MG	MG	M	MG	G	G	MG	VG	G
C_{15}	G	VG	MG	G	M	G	AG	M	G	VG
C_{16}	MG	VG	G	G	G	MG	G	G	G	MG
C_{17}	G	G	VG	M	G	VG	MG	G	MG	G
C_{18}	G	MP	MG	G	M	VG	G	M	VG	AG
C_{19}	VG	G	G	AG	G	G	MG	VG	VG	AG
C_{110}	MG	VG	AG	VG	AG	MP	MG	G	G	G
C_{21}	G	G	AG	AG	VG	G	G	G	MP	G
C_{22}	AG	G	G	G	G	VG	VG	MG	G	AG
C_{23}	M	MG	G	MG	AG	G	MG	VG	VG	G
C_{24}	M	VG	AG	M	G	G	G	VG	G	MG
C_{25}	MG	VG	MG	G	MG	MG	AG	G	G	M
C_{31}	G	AG	M	G	M	VG	AG	MP	M	G
C_{32}	MG	G	AG	M	G	AG	G	G	VG	G
C_{33}	M	MG	G	VG	G	G	G	VG	G	M
C_{34}	MP	M	AG	G	MG	MG	AG	G	G	G
C_{35}	G	G	G	G	MG	M	MG	G	MG	AG
C_{36}	AG	G	MG	MG	G	G	M	MG	MG	VG
C_{37}	G	M	M	AG	VG	G	G	VG	G	G
C_{38}	MG	G	G	G	MG	M	VG	VG	VG	G
C_{39}	MG	G	G	MG	G	G	MG	G	MG	MG
C_{310}	VG	MG	M	M	AG	AG	M	MP	G	VG
C_{311}	G	MG	G	G	AG	VG	G	G	AG	VG
C_{312}	G	G	AG	G	G	G	AG	M	AG	G
C_{41}	M	VG	VG	G	G	MG	G	VG	G	MP
C_{42}	MG	MG	G	G	AG	M	MG	G	G	G
C_{43}	G	G	MG	MG	MG	VG	M	AG	AG	M
C_{44}	MG	AG	VG	VG	M	G	G	G	MG	VG
C_{45}	M	AG	AG	VG	AG	G	G	MG	M	AG
C_{46}	G	G	G	G	VG	MG	M	M	G	G
C_{47}	G	M	MG	MP	G	M	G	G	VG	MG
C_{51}	MG	G	G	MG	MP	VG	VG	M	AG	VG
C_{52}	M	AG	AG	M	MG	VG	MG	G	M	M
C_{53}	G	AG	VG	G	M	VG	M	AG	MG	MG
C_{54}	MG	G	M	MG	AG	VG	VG	VG	MP	M
C_{55}	M	MP	VG	AG	VG	MG	G	G	MG	G
C_{56}	VG	MG	G	G	VG	M	AG	AG	M	MP

Table 8: Computation of FPII of individual leagile attributes

Leagile Attributes	Corresponding Fuzzy Performance Importance Index (FPII)	Degree of Similarity with respect to ideal FPII	Ranking order
C_{11}	[(0.028,0.052,0.130,0.174;0.800),(0.028,0.052,0.130,0.174;1.000)]	0.9318	27
C_{12}	[(0.012,0.033,0.102,0.134;0.800),(0.012,0.033,0.102,0.134;1.000)]	0.9131	33
C_{13}	[(0.043,0.072,0.170,0.213;0.800),(0.043,0.072,0.170,0.213;1.000)]	0.9594	16
C_{14}	[(0.040,0.067,0.164,0.207;0.800),(0.040,0.067,0.164,0.207;1.000)]	0.9557	20
C_{15}	[(0.030,0.060,0.161,0.209;0.800),(0.030,0.060,0.161,0.209;1.000)]	0.9527	22
C_{16}	[(0.052,0.086,0.201,0.261;0.800),(0.052,0.086,0.201,0.261;1.000)]	0.9800	3
C_{17}	[(0.012,0.036,0.118,0.161;0.800),(0.012,0.036,0.118,0.161;1.000)]	0.9240	29
C_{18}	[(0.008,0.022,0.074,0.107;0.800),(0.008,0.022,0.074,0.107;1.000)]	0.8938	37
C_{19}	[(0.045,0.080,0.194,0.252;0.800),(0.045,0.080,0.194,0.252;1.000)]	0.9750	7
C_{110}	[(0.029,0.056,0.143,0.184;0.800),(0.029,0.056,0.143,0.184;1.000)]	0.9408	25
C_{21}	[(0.034,0.069,0.186,0.246;0.800),(0.034,0.069,0.186,0.246;1.000)]	0.9702	9
C_{22}	[(0.045,0.083,0.200,0.256;0.800),(0.045,0.083,0.200,0.256;1.000)]	0.9782	4
C_{23}	[(0.016,0.033,0.097,0.141;0.800),(0.016,0.033,0.097,0.141;1.000)]	0.9094	35
C_{24}	[(0.047,0.084,0.206,0.259;0.800),(0.047,0.084,0.206,0.259;1.000)]	0.9825	2
C_{25}	[(0.015,0.032,0.093,0.132;0.800),(0.015,0.032,0.093,0.132;1.000)]	0.9070	36
C_{31}	[(0.053,0.085,0.187,0.236;0.800),(0.053,0.085,0.187,0.236;1.000)]	0.9699	10
C_{32}	[(0.032,0.063,0.167,0.216;0.800),(0.032,0.063,0.167,0.216;1.000)]	0.9569	19
C_{33}	[(0.038,0.073,0.193,0.252;0.800),(0.038,0.073,0.193,0.252;1.000)]	0.9745	8
C_{34}	[(0.023,0.053,0.160,0.218;0.800),(0.023,0.053,0.160,0.218;1.000)]	0.9532	21
C_{35}	[(0.048,0.076,0.174,0.227;0.800),(0.048,0.076,0.174,0.227;1.000)]	0.9621	12
C_{36}	[(0.036,0.067,0.170,0.214;0.800),(0.036,0.067,0.170,0.214;1.000)]	0.9593	17
C_{37}	[(0.018,0.040,0.113,0.154;0.800),(0.018,0.040,0.113,0.154;1.000)]	0.9205	30
C_{38}	[(0.029,0.056,0.147,0.194;0.800),(0.029,0.056,0.147,0.194;1.000)]	0.9437	24
C_{39}	[(0.035,0.065,0.173,0.224;0.800),(0.035,0.065,0.173,0.224;1.000)]	0.9619	13
C_{310}	[(0.013,0.038,0.124,0.172;0.800),(0.013,0.038,0.124,0.172;1.000)]	0.9278	28
C_{311}	[(0.055,0.083,0.174,0.229;0.800),(0.055,0.083,0.174,0.229;1.000)]	0.9611	15
C_{312}	[(0.033,0.065,0.169,0.219;0.800),(0.033,0.065,0.169,0.219;1.000)]	0.9583	18
C_{41}	[(0.006,0.018,0.061,0.093;0.800),(0.006,0.018,0.061,0.093;1.000)]	0.8833	39
C_{42}	[(0.038,0.072,0.193,0.254;0.800),(0.038,0.072,0.193,0.254;1.000)]	0.9753	6
C_{43}	[(0.018,0.038,0.110,0.154;0.800),(0.018,0.038,0.110,0.154;1.000)]	0.9187	31
C_{44}	[(0.053,0.095,0.231,0.286;0.800),(0.053,0.095,0.231,0.286;1.000)]	0.9985	1
C_{45}	[(0.020,0.058,0.174,0.229;0.800),(0.020,0.058,0.174,0.229;1.000)]	0.9612	14
C_{46}	[(0.006,0.017,0.064,0.107;0.800),(0.006,0.017,0.064,0.107;1.000)]	0.8858	38
C_{47}	[(0.031,0.059,0.160,0.215;0.800),(0.031,0.059,0.160,0.215;1.000)]	0.9532	21
C_{51}	[(0.028,0.053,0.141,0.189;0.800),(0.028,0.053,0.141,0.189;1.000)]	0.9394	26
C_{52}	[(0.021,0.037,0.099,0.139;0.800),(0.021,0.037,0.099,0.139;1.000)]	0.9106	34
C_{53}	[(0.033,0.067,0.179,0.232;0.800),(0.033,0.067,0.179,0.232;1.000)]	0.9647	11
C_{54}	[(0.040,0.066,0.153,0.204;0.800),(0.040,0.066,0.153,0.204;1.000)]	0.9470	23
C_{55}	[(0.017,0.037,0.109,0.152;0.800),(0.017,0.037,0.109,0.152;1.000)]	0.9177	32
C_{56}	[(0.058,0.091,0.196,0.249;0.800),(0.058,0.091,0.196,0.249;1.000)]	0.9757	5

Ideal Fuzzy Performance Importance Index (FPII) = [(0.058, 0.095, 0.231, 0.286; 0.800), (0.058, 0.095, 0.231, 0.286; 1.000)]