A Unique Assessment Framework for Employee Engagement in Software Development Projects

Vaisali K.S and M. Suresh
Amrita School of Business
Coimbatore, Amrita Vishwa Vidyapeetham, India
vaisaliksmi@gmail.com; m_suresh@cb.amrita.edu; drsureshcontact@gmail.com

Abstract

An employee engagement assessment is implemented in many software development projects to access cognitive engagement and overall employee satisfaction. This paper develops the assessment framework for employee engagement levels in Software Development Projects (SDP) using the multi-grade fuzzy approach. The case study has been conducted and the results found that the employee engagement index of case SDP organization is 7.11, which indicates that the 'moderately engaged'. An Importance Performance Analysis is used to identify the weaker attributes. This framework will help SDP organization's managers to measure the employee engagement and give more importance to the weaker attributes to boost their engagement level.

Keywords
Software development projects, Employee engagement, Employee satisfaction, Cognitive engagement, Multi-grade fuzzy

1. Introduction
A software development project is a multi-person effort where the codes are generated and improved to add significant value to the current or new business process while staying within the constraints of time, budget, and personnel resources. These initiatives must meet certain criteria, including the ability to offer considerable business value and the fact that they are not minor enterprises. High visibility, moderate to high complexity, and urgency in requirements will be the factors of these development projects that add significant value to the businesses. Software engineers typically employ engineering concepts to design software and systems in order to solve problems. They usually aim to solve an issue or bring in a solution for everyone, rather than for a specific person, customer, or situation. To bring in these changes and answers, they use modeling languages and tools. The solutions they propose are for real-world problems that can be solved in real-time, such as an elevator or a bridge.

The amount of enthusiasm and engagement an employee shows towards the work is described as employee engagement, which is a concept under human resources. The more the employees are engaged, the more they care about their work and how to improve the performance of the organization and will understand that their efforts count. Some smaller organizations are unaware of the concepts of employee engagement assessment. Productivity and efficiency improve upon the effective implementation of employee engagement assessment practices. In organizations, the effectiveness of the employee engagement assessment depends on specific employee engagement attributes that are identified and evaluated. This paper focuses on developing a framework for calculating employee engagement levels in the organization and provides suggestions to improve weaker attributes.

The study aims to answer the below Research Question (RQ)s:
RQ1: How can employee engagement be measured in software development projects?
RQ2: What are the enablers, criteria, and attributes that influence engagement of employees in software development projects?
RQ3: How can weaker attributes be addressed to enhance employee engagement in software development projects?

2. Literature Review
In management performance and practice, employee engagement is a critical factor. And there is no definite standard for evaluating employee engagement. Sun and Bunchapattanasakda (2019) examines and derives from prior employee engagement research findings. Here, employee engagement is defined as a combination of both multi-faceted

constructs and unitary constructs. Three theoretical frameworks are used here to explain employee engagement, which are: The Need Satisfaction framework, the Job Demands-Resources model, and the Social Exchange theory. The three factors identified that influence employee engagement are: organizational factors, job factors, and individual factors. In this study, it is found that employee engagement has a critical association with individual and organizational performance. The following are the flaws the research appears to have found: lack of research on demographic variables, personality differences, cross-cultural differences in employee engagement, lack of research on the mediating, and lack of research when it comes to employee engagement intervention mechanism (Sun and Bunchapattanasakda, 2019).

The economic development of a country critically depends upon the IT industry's smooth performance so that long-term growth and development can be achieved with minimum hindrances. To carry out such a critical and highly responsible process they need to have skilled and experienced employees who are available at any given time. As employees are key to this process, it has been observed that employee turnover is high due to global and local problems around the world. To handle this issue and reduce the turnover rate scholars have shifted their focus on talent management so that it decreases employee turnover and increases employee engagement and retention.

Alias et al., (2016) study is a quantitative measure conducted in Selangor, and it focuses on three items, namely: talent management practices, employee engagement, and employee retention. After performing the hierarchical regression analysis where employee engagement is a mediator, it was found that employee engagement mediates the relationship between talent management and employee retention individually. They also states that employee engagement is positively correlated with talent management practices, which is similar to the findings of the Pearson correlation analysis, and it was found to have a good relationship with employee retention.

A robust construction of employee engagement covers all facets of human resource management. In a successful management system, employee engagement in their job role with high involvement and enthusiasm is achieved by appropriately addressing all parts of human resources. McBain (2007) constructs employee engagement by relating to organizational performance success as a two-way relationship between employer and employee instead of an earlier framework with three concepts: job satisfaction, employee commitment, and organizational citizenship behavior. The employee achieves beyond the target with great enthusiasm and high involvement (McBain, 2007).

Little and Little (2006) explore the construct of employee engagement by defining the framework and comparing and contrasting it with existing standard constructs. They discuss the positives and negatives of employee engagement research and the application of the construct along with the organizational outcomes. It is believed that a higher level of employee engagement improves productivity, turnover, profitability, and safety. They encourage readers to explore further employee engagement constructs with a better understanding of what they measure and predict for a successful management system (Little and Little, 2006).

Abraham (2012) focuses on the employee satisfaction scale, and employee engagement programs should be developed so as to increase productivity. This study concludes by addressing how imperative it is for software and IT companies to understand the needs of their employees. As this helps them strengthen the employee's motivation, satisfaction, and determination to reduce employee turnover by increasing their commitment (Jyothi and Ravindran, 2012). Due to the increased number of dissatisfied employees, overall employment has been an area of high concern for employers. Arora and Vyas (2020) analysis show that extrinsic satisfaction factors are significantly positive in nature. The management has to focus on increasing the intrinsic satisfaction level so as to enhance the overall employee satisfaction in the company.

3. Research Methodology
3.1 Multi-grade fuzzy
In manufacturing and service industries assessment the multi-grade fuzzy was applied to study lean, agile, performance, safety practice level, and supply chain management effectiveness (Vinodh and Aravindraj, 2015; Sridharan and Suresh, 2016; Ganesh and Suresh, 2016; Vinodh and Chintha, 2011; Vimal et al., 2015; Almutairi et al., 2019; Anil and Suresh, 2020).

The study utilized multi-grade fuzzy to assess employee engagement in software development projects (SDP). The current study starts with a literature review on employee engagement in software development organizations and a

multi-grade fuzzy assessment. A new conceptual model was developed to assess the employee engagement index with one enabler, nine criteria, and thirty-nine attributes are given in Table 1.

Table 1. Conceptual model of employee engagement in SDP

Enablers	Criteria	Attributes
Employee Engagement (E1)	Cognitive Engagement (E11)	Work is designed in such a way that employees never think about other things while working (E111)
		Work is framed in such a way that employees pass time quickly while working (E112)
		Work is assigned in such a way that employees rarely get distracted (E113)
	Emotional Engagement (E12)	Felt a great deal of personal meaning while working in this organization (E121)
		Strong sense of belonging (E122)
		Believing in the mission and purpose of the organization (E123)
		Feel proud to tell others about my current organization (E124)
		Caring about the organization's future (E125)
	Behavioral Engagement (E13)	Willing to put in extra effort without being asked (E131)
		Do more than what is expected to help the team be successful (E132)
		Working harder than expected to help a organization be successful (E133)
		Exerting a lot of energy while performing the job (E134)
	Meaningfulness (E14)	Considering the work to be done is important or significant (E141)
		Considering the job/work is worthwhile (E142)
		Considering the work that is carried out is valuable (E143)
		Considering the work that is carried out in this job is meaningful (E144)
	Psychological availability (E15)	Confidence in handling competing demands, including physical demands (E151)
		Confident in dealing with problems that come up at work (E152)
		Confident in one's ability to think clearly at work (E153)
	Rewards, recognition, and motivation (E16)	Travel benefits (E161)
		Financial incentives and tax benefits (E162)
		Recognition or Bonus pay for achievement (E163)
		Involving employees in formulating strategy and decision-making processes (E164)
		Mutual learning environment (E165)
		Encouraging employees to get involved in problem-solving (E166)
		Conducting sessions and workshops for career development and enhancement (E167)
		Providing awards for excellence (E168)
	Work Environment (E17)	Dedicated to diversity and inclusiveness (E171)
		Creating a pleasant culture in the workplace (E172)
		Operating in a socially responsible manner (E173)
		Providing an atmosphere of job security (E174)
		Safe work environment (E175)
		Spacious workspace and workplace (E176)
	Rewarding Co-worker relations (E18)	Co-workers showing mutual respect for one another (E181)
		Employees sense a real connection with co-workers (E182)
		Valuing other co-workers' input (E183)
		Trusting co-workers (E184)
		Interaction with co-workers is rewarding (E185)
		Feel bonded and close to the people at work (E186)
		Co-workers appreciate employees for whom they are (E187)

		Co-workers listen to what others want to say (E188)
	Supportive supervisor relations (E19)	Helping employees solve work-related problems (E191)
		Encouraging employees to develop new skills (E192)
		Keeping employees informed about how they think and feel about things (E193)
		Appreciating good work (E194)
		Motivating employees to speak up when they disagree with a decision (E195)
		Treating all employees fairly (E196)
		Committed to protecting employees' interests (E197)
		Trusting supervisors (E198)

4. Case Study

4.1 Case of the software development project

The case software development project organization is located in India. Its mission is to explore the potential of technology and human innovation. They use change to produce new and remarkable value for their customers, employees, and communities. The post-digital era is far from over, and the need for quick business transformation has never been greater. They work with customers in every industry throughout the world, meeting them where they are on their transformation journeys and partnering with them to create long-term value.

A multi-grade fuzzy approach is used to evaluate a software development project's employee engagement level. The first phase comprises a review of the literature, the identification of experts, and discussions with them to finalize the characteristics of the employee engagement level.

The employee engagement index, represented by E. It is the product of the overall assessment level of ratings based on each driver (R) and the overall weights (W) given by the experts. The equation for the employee engagement index is

$E = W \times R$ (Vinodh, 2011; Suresh et al., 2020)

The overall assessment is categorized into ten grades as the entire employee engagement index follows fuzzy determination. H = {10, 9, 8, 7, 6, 5, 4, 3, 2, 1}. 9-10 denotes 'Extremely engaged', 8–9 denotes 'Highly engaged', 7–8 denotes 'Moderately engaged', 6–7 denotes 'Slightly engaged', 5–6 denotes 'Engaged', 4–5 denotes 'Disengaged', 3–4 denotes 'Slightly disengaged, 2–3 denotes 'Moderately disengaged', 1–2 denotes 'Highly disengaged', and less than 1 denotes 'Extremely disengaged'. For the attribute's ratings, we developed a questionnaire with a 10-point Likert scale representing extremely high (10 points) to extremely low (1 point). The reverse scale is used to capture ratings for negative attributes; the minimum is the best. The weightage has been collected from five experts from various SDPs using a 10-point Likert scale, representing extremely high importance (10 points) to extremely low importance (1 point). The employee engagement ratings are collected from five experts of case SDP. It is depicted in Table 2.

Table 2. Weights and Performance rating

Ei	*Eij*	*Eijk*	R1	R2	R3	R4	R5	*Wijk*	*Wij*	*W*
E1	E11	E111	6	7	6	6	6	0.3678	0.1079	
		E112	2	8	8	5	7	0.2874		
		E113	7	5	5	5	5	0.3448		
	E12	E121	7	8	7	5	7	0.2258	0.1015	
		E122	7	9	7	8	7	0.2		
		E123	6	4	5	5	6	0.1806		
		E124	8	8	8	7	8	0.2194		
		E125	8	3	5	7	5	0.1742		
	E13	E131	8	4	8	8	7	0.2564	0.1047	
		E132	8	5	8	7	8	0.2479		
		E133	6	5	6	6	5	0.2393		
		E134	9	6	7	5	7	0.2564		
	E14	E141	10	6	8	6	6	0.223	0.1079	

		E142	9	6	8	8	8	0.259		
		E143	9	4	7	7	6	0.259		
		E144	9	8	8	7	8	0.259		1
	E15	E151	9	6	5	7	7	0.2804	0.1238	
		E152	8	7	7	8	6	0.3738		
		E153	8	9	5	8	8	0.3458		
	E16	E161	10	9	5	7	7	0.117	0.1015	
		E162	6	7	8	8	6	0.1283		
		E163	9	7	6	6	7	0.1208		
		E164	9	4	7	5	7	0.1358		
		E165	7	6	9	6	6	0.1321		
		E166	8	7	8	6	8	0.1283		
		E167	8	7	8	7	7	0.1208		
		E168	10	8	9	7	7	0.117		
	E17	E171	10	8	9	7	9	0.1705	0.1333	
		E172	9	9	9	8	9	0.1705		
		E173	10	7	7	8	7	0.1382		
		E174	9	7	7	8	8	0.1613		
		E175	9	9	9	9	9	0.1935		
		E176	9	9	8	9	9	0.1659		
	E18	E181	8	9	8	9	9	0.1496	0.1142	
		E182	6	8	7	7	7	0.1387		
		E183	7	8	8	7	8	0.1387		
		E184	6	7	7	7	6	0.1095		
		E185	3	6	7	7	6	0.1277		
		E186	9	8	6	8	8	0.1022		
		E187	7	8	6	7	6	0.1204		
		E188	7	7	6	7	6	0.1131		
	E19	E191	8	8	8	4	5	0.1225	0.1047	
		E192	9	8	8	5	6	0.1383		
		E193	8	7	7	7	6	0.1304		
		E194	8	7	8	5	7	0.1304		
		E195	9	7	6	6	6	0.1265		
		E196	6	5	8	8	7	0.1225		
		E197	8	6	6	8	8	0.0988		
		E198	7	5	7	8	7	0.1304		

Primary assessment calculation

Primarily the "Cognitive engagement (E11)" is calculated as given below.

The "Cognitive engagement" criterion weights are $W_{11} = [0.367, 0.287, 0.344]$

The practice of "Cognitive engagement" criterion assessment is given below as

$$R_{11} = \begin{bmatrix} 6 & 7 & 6 & 6 & 6 \\ 2 & 8 & 8 & 5 & 7 \\ 7 & 5 & 5 & 5 & 5 \end{bmatrix}$$

Index concerning of "Cognitive engagement" criterion is given by

$E_{11} = W_{11} \times R_{11}$

$E_{11} = [5.195, 6.597, 6.229, 5.367, 5.942]$

By utilizing the above principle, the index concerning the following criteria in employee engagement assessment obtained is given below.

$E_{12} = [7.212, 6.606, 6.509, 6.387, 6.690]$

$E_{13} = [7.777, 5.000, 7.264, 6.504, 6.769]$

E_{14} = [9.223, 6.000, 7.741, 7.035, 7.035]
E_{15} = [8.280, 7.411, 5.747, 7.719, 6.971]
E_{16} = [8.335, 6.811, 7.520, 6.475, 6.867]
E_{17} = [9.308, 8.230, 8.235, 8.188, 8.562]
E_{18} = [6.594, 7.671, 6.952, 7.401, 7.069]
E_{19} = [7.889, 6.656, 7.288, 6.320, 6.458]

Secondary assessment calculation

The calculation concerning to enabler of "Employee engagement (*E1*)" is given below as
Weights concerning to "Employee engagement" enabler given as W_1 = [0.1079, 0.1015, 0.1047, 0.1079, 0.1238, 0.1015, 0.1333, 0.1142; 0.1047]
Assessment of "Employee engagement" enabler is given as below

$$E_1 = \begin{bmatrix} 5.195 & 6.597 & 6.229 & 5.367 & 5.942 \\ 7.212 & 6.606 & 6.509 & 6.387 & 6.690 \\ 7.777 & 5.000 & 7.264 & 6.504 & 6.769 \\ 9.223 & 6.000 & 7.741 & 7.035 & 7.035 \\ 8.280 & 7.411 & 5.747 & 7.719 & 6.971 \\ 8.335 & 6.811 & 7.520 & 6.475 & 6.867 \\ 9.308 & 8.230 & 8.235 & 8.188 & 8.562 \\ 6.594 & 7.671 & 6.952 & 7.401 & 7.069 \\ 7.889 & 6.656 & 7.288 & 6.320 & 6.458 \end{bmatrix}$$

Index concerning of "Employee engagement" enabler is given by
$E_1 = W_1 \times R_1$
E_1 = [7.797, 6.835, 7.062, 6.882, 6.976]

Tertiary assessment calculation

The employee engagement assessment value of case SDP's calculated as follows
Complete weight W = [1]
Complete assessment vector R = [7.797, 6.835, 7.062, 6.882, 6.976]
Employee engagement index $E = W \times R$
E = [7.797, 6.835, 7.062, 6.882, 6.976]
The final employee engagement index is the average of E = 7.11 ∈ (7 to 8). ∴ 'Moderately engaged'

4.2 Importance Performance Analysis (IPA)

In manufacturing and service industries, IPA is widely used for identifying weaker attributes based on their importance and performance (Chacko et al., 2021; Vaishnavi and Suresh, 2021). In IPA, the performance rating is on the x-axis and the importance is on the y-axis (Sreedharshini et al., 2021). The mean of the x-axis is 7.12 and the mean of the y-axis is 6.58 as a perpendicular line in Table 3.

Table 3. IPA analysis for employee engagement assessment of case SDP

											E175
8.4	**Quadrant -I**						**Quadrant -II**				
8.2										E181	
8					E152						
7.8											
7.6				E182		E183					
7.4						E153				E171, E172	
7.2			E164	E143				E142	E144	E176	
7		E185			E121,E165	E192		E174			
6.8					E162		E166	E124			
6.6					E187,E193, E194						

(Importance ↑ on y-axis)

	5.2	5.5	5.8	6.1	6.4	6.7	7	7.3	7.6	7.9	8.2	8.5	8.8	9.1
6.4				E111		E163,E195	E167							
6.2					E188,E191	E196	E141	E122,E161		E168				
6		E113			E184	E131,E135,E151		E173						
5.8							E132							
5.6	E123		E134					E186						
5.4			E125											
5.2														
5	E198		E112			Quadrant -IV	E197						Quadrant -III	

Performance Rating →

Quadrant I (concentrate here): The attributes of this quadrant need to be paid attention to by the case-SDP's managers to increase the employee engagement level of their project. The attributes are "Feeling a great deal of personal meaning while working in this organization; considering the work that is carried out is valuable; financial incentives and tax benefits; involving employees in formulating strategy and decision-making process; climate for mutual learning; employees sense a real connection with co-workers; interaction with co-workers is rewarding".

Quadrant II (Keep up the good work): The attributes in the quadrant need to be maintained as the same (Suresh and Gopakumar, 2021) and the attributes are "Feeling proud to tell others about the current organization; considering the job/work is worthwhile; considering the work that is carried out in this job is meaningful; confident in dealing with problems that come up at work; confident to think clearly at work; encouraging employees to get involved in problem-solving; dedicated to diversity and inclusiveness; creating a pleasant culture at the workplace; providing an atmosphere of job security; safe work environment; spacious workspace and workplace; co-workers showing mutual respect for one another; valuing other co-workers' input; encouraging employees to develop new skills".

Quadrant III (Possible overkill): In this quadrant, the attributes are low of importance but high performance (Subramanian and Suresh, 2022). The performance of these attributes should be minimized. The attributes are a "Strong sense of belonging; doing more than what is expected to help the team be successful; considering the work to be done is important/significant, travel benefits, conducting sessions and workshops for career development and enhancement; offering excellence awards; operating in a socially responsible manner; feel bonded and close to the people at work; committed to protecting employees' interests".

Quadrant IV (Low priority): The attributes in this quadrant are of low importance and low performance (Thomas and Suresh, 2022). The attributes are "Work is designed in such a way that employees never think about other things while working; work is framed in such a way that employees pass time quickly while working; work is assigned in such a way that employees rarely get distracted; believing in the mission and purpose of the organization; caring about the organization 's future; willing to put in extra effort without being asked; working harder than expected to help the organization to be successful; exerting a lot of energy while performing the job; confidence in handling competing demands including physical demands; recognition/ bonus pay for achievement; trusting co-workers, co-workers appreciate employees for whom they are; co-workers listen to what others want to say; helping employees to solve work-related problems; keeping employees informed about how they think and feel about things; appreciating good work; motivating employees to speak up when they disagree a decision; treating all employees fairly, trusting supervisors".

5. Results and discussions

For the improvement of weaker attributes following suggestions are given in Table 4.

Table 4. Suggestions for improvement of weaker attributes

Weaker attributes	Suggestions for improvement
Feeling a great deal of personal meaning while working in this organization	• Build a learning environment that energizes and maximizes personal growth and helps them understand the purpose of their work and shows that their work matters

| Considering the work that is carried out is valuable	• They should be offered good compensation packages, work-life balance should be prioritized, and employee recognition programs should be launched.
Financial incentives and tax benefits	• Providing performance bonus
Involving employees in formulating strategy and decision-making process	• Employees should be included in the decision-making process, and their suggestions and input should be valued.
Climate for mutual learning	• Training programs, upskilling learning, and development programs should be conducted periodically, group discussion should be encouraged so employees can learn from each other.
Employees sense a real connection with co-workers	• Conducting team activities and having meals with their team members will help them know each other better and can form a real connection.
Interaction with co-workers is rewarding	• Employees should be encouraged and supported to interact with their co-workers as this would increase work satisfaction, good feeling, and a sense of belongingness.
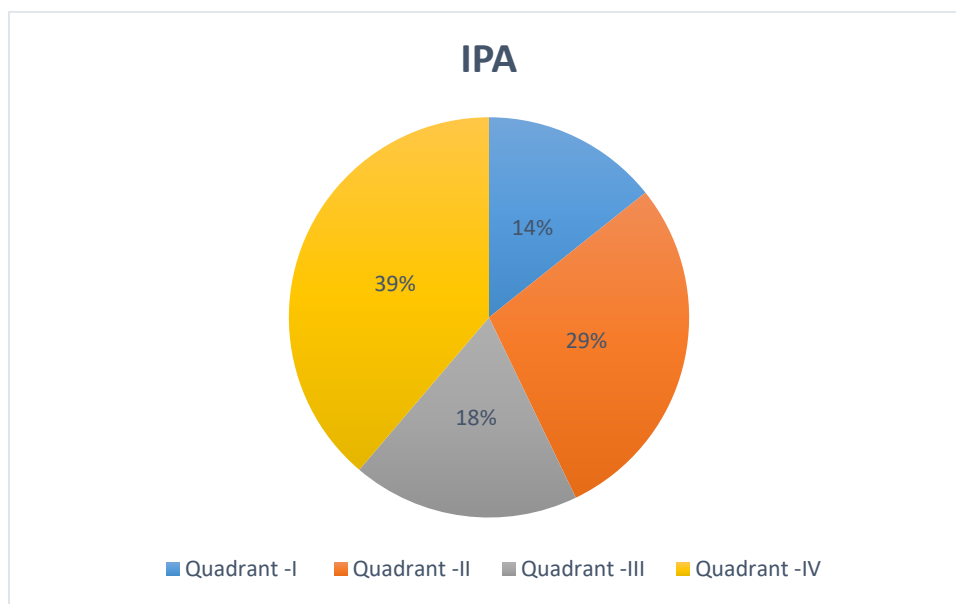
Figure 1. Graphical representation of IPA

Figure 1 shows the graphical representation of IPA. 14% of the factors in quadrant I need concentration and the management should take appropriate actions to improve it.

6. Practical Implication

In this study, a comprehensive list of forty-nine attributes of employee engagement is provided. From both a theoretical and practical standpoint, this study gives a better understanding of employee engagement in software development projects. Furthermore, this study has several implications for both research and practices. The findings of this study have far-reaching implications for strategies on a daily basis. This study presents a detailed list of employee engagement strategies that help both individual and organizational employee engagement. According to experts' opinions, the software development team should adopt an employee engagement assessment that improves organizational effectiveness. Senior management should ensure that the employee engagement process induces the necessary steps to enable a smooth transition in their workplace operations. The management of SDP must draw on

their present jobs' functional experience and, through continuous training and education in their specific sector, assist people in upgrading their skills and knowledge.

7. Conclusion

This study mainly focuses on employee engagement in the case organization. The level of enthusiasm and involvement the employee has towards his/her work is called employee engagement. The employee engagement assessment is constructed by using a multi-grade fuzzy approach, and IPA is used to identify the weak attributes. In order to improve weaker attributes and to gain a competitive advantage, suggestions are provided as well. This study categorizes the case-SDP organization as "moderately engaged" but there are chances to achieve the "extremely engaged" category level. The assessment framework can be further explored by incorporating additional employee engagement attributes specific to the project's location and work environment.

References

Abraham, S., Development of employee engagement programme on the basis of employee satisfaction survey. *Journal of economic development, management, IT, finance, and marketing*, *4*(1), 27, 2012.

Alias, N. E., Nor, N. M., & Hassan, R., The relationships between talent management practices, employee engagement, and employee retention in the information and technology (IT) organizations in Selangor. In *Proceedings of the 1st AAGBS International Conference on Business Management 2014 (AiCoBM 2014)* (pp. 101-115). Springer, Singapore, 2016.

Almutairi, A. M., Salonitis, K., & Al-Ashaab, A., Assessing the leanness of a supply chain using multi-grade fuzzy logic: a health-care case study. *International Journal of Lean Six Sigma*. 10(1), 81-105, 2019.

Anil, M., & Suresh, M., Assessment of Service Agility in Power Distribution Company. In *IOP Conference Series: Materials Science and Engineering*, 954(1), 012010, 2020, October.

Arora, S., & Vyas, S., Job satisfaction at the time of COVID-19: An investigation of information technology sector in India. *Mukt Shabd Journal*, *9*(9), 251-263, 2020.

Chacko, E., Suresh, M., & Priyadarsini, S. L., Start-Up Leagility Assessment Using Multi-grade Fuzzy and Importance Performance Analysis. In *Data Intelligence and Cognitive Informatics* (pp. 397-407). Springer, Singapore, 2021.

Ganesh, J., & Suresh, M., Safety practice level assessment using multigrade fuzzy approach: a case of Indian manufacturing company. In 2016 IEEE International Conference on *Computational Intelligence and Computing Research (ICCIC)* (pp. 1-5). IEEE, 2016, December.

Jyothi, B. S., & Ravindran, P. T., Employee job satisfaction in software and ITeS units in Bangalore-An empirical study. *Business Management Dynamics*, *2*(6), 46, 2012.

Little, B., & Little, P., Employee engagement: Conceptual issues. *Journal of Organizational Culture, Communications and Conflict*, *10*(1), 111-120, 2006.

McBain, R., The practice of engagement: Research into current employee engagement practice. *Strategic HR review*. 6(6), 16-19, 2007.

Sreedharshini, S., Suresh, M., & Priyadarsini, S. L., Workplace Stress Assessment of Software Employees Using Multi-grade Fuzzy and Importance Performance Analysis. In *Data Intelligence and Cognitive Informatics* (pp. 433-443). Springer, Singapore, 2021.

Sridharan, V., & Suresh, M., Environmental sustainability assessment using multigrade fuzzy—A case of two Indian colleges. In 2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC) (pp. 1-4). IEEE, 2016, December.

Subramanian, N., & Suresh, M., Assessment Framework for Agile HRM Practices. *Global Journal of Flexible Systems Management*, 23, 135–149, 2022.

Sun, L., & Bunchapattanasakda, C., Employee engagement: A literature review. *International Journal of Human Resource Studies*, *9*(1), 63-80, 2019.

Suresh, M., & Gopakumar, K., Multi-grade fuzzy assessment framework for software professionals in work-from-home mode during and post-COVID-19 era. *Future Business Journal*, *7*(1), 1-9, 2021.

Suresh, M., Yuvaprasanth, R., Arun Ram Nathan, R.B., & Amarnath, K., Employees stress level assessment: a case of apparel industry. In *IOP Conference Series: Materials Science and Engineering,* 954(1), 012018, 2020, October.

Thomas, A., & Suresh, M., Assessment of COVID-19 prevention and protection measures in hospitals. *Cleaner Engineering and Technology*, *7*, 100440, 2022.

Vaishnavi, V., & Suresh, M., Assessment of Leagility in Healthcare Organization Using Multi-grade Fuzzy Approach. In *Data Intelligence and Cognitive Informatics* (pp. 409-421). Springer, Singapore, 2021.

Vimal, K. E. K., Vinodh, S., & Muralidharan, R., An approach for evaluation of process sustainability using multi-grade fuzzy method. *International Journal of Sustainable Engineering*, *8*(1), 40-54, 2015.

Vinodh, S. Assessment of sustainability using multi-grade fuzzy approach. *Clean Technologies and Environmental Policy*, *13*(3), 509-515, 2011.

Vinodh, S., & Aravindraj, S., Benchmarking agility assessment approaches: a case study. *Benchmarking: An International Journal*, *22*(1), 2-17, 2015.

Vinodh, S., & Chintha, S. K., Leanness assessment using multi-grade fuzzy approach. *International Journal of Production Research*, *49*(2), 431-445, 2011.

Biographies

Vaisali K.S is an MBA final year student at Amrita School of Business, Amrita Vishwa Vidyapeetham, Coimbatore, India. Her research interests include business analytics, organizational behavior, leadership, service operations. She is currently working on human resources management.

Suresh M. is an Associate Professor at Amrita School of Business, Amrita Vishwa Vidyapeetham, Coimbatore, India. He holds a PhD in Project Management from Indian Institute of Technology, Bombay, India and Master's in Industrial Engineering from PSG College of Technology, Coimbatore, India. His research interests include issues related to lean and agile operations and performance management. He has authored several papers in Operations. He is also a member of International Society on Multiple Criteria Decision Making.