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An exploration of FMCDM approach for evaluating the outcome/success of GSD projects

Research Article

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Abstract: This study presents a fuzzy multi-criteria decision making (FMCDM) approach for analyzing the influential factors affecting the outcome/success of global software development (GSD) projects. The main aim of this study is to demonstrate the potential of proposed methodology based on FMCDM which is used to measure the offshore/on-site teams' partnership quality dimensions and underlying the influential factors towards the outcome of GSD projects. The uncertainty and subjective vagueness within the decision making process are dealing with fuzzy linguistic terms quantified in an interval scale [0,1]. The proposed FMDCM framework is used to determine the priority weights of partnership quality factors and rating the GSD project outcome/success from the service provider perspective into three dimensions: service quality, schedule and cost improvement. The predicted GSD project outcome values are obtained to facilitate organization and to determine the impact of offshore/on-site teams' partnership quality towards success of GSD project outcome otherwise initiate actions to improve the GSD project outcome. This study established survey research method that involves thirty-eight critical influential factors evaluated by twenty software professionals for their assessment of GSD projects outcome in India.

Keywords: Global software development • Fuzzy multi-criteria decision making • GSD project outcome • Linguistic variables • Partnership quality • Triangular fuzzy numbers.

1. Introduction

Global software development is primarily an outsourcing technique where the offshore/on-site teams worked in a multi-site environment to develop a high quality software product in different settings. Nowadays Indian software companies have emerged multi-fold in such a way that it promotes the global outsourcing and competes with leading worldwide suppliers across the Information Technology (IT) solutions spectrum. In addition, the recent report by National Association of Software and Service Companies (NASSCOM) and McKinsey report pointed out that IT outsourcing services in India will grow five-fold by 2020 from $90 billion to $100 billion, driven mainly by economic growth rather than customer behaviors. In addition, this report also stated that 65% of all Capability Maturity Model (CMM) level five companies are based in India.

Many studies are reported that the partnership quality factors have been major impact on GSD project outcome/success. Partnership quality refers to 'how well the outcome of a partnership delivered matches the participants' expectations' [1]. According to the literature review partnership quality factors are

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observed only from service provider (vendor) and service receiver (client) perspective in a mature relationship [2–7]. Our earlier work [8, 9] reveals partnership quality of offshore/on-site teams' has been key predictor of GSD project outcome from the service provider perspective. Waheed [10] has stated that the success of Information System (IS) outsourcing by means of project completion within time and budget limit, yields better quality of IS and knowledge transfer. Consequently, King [11] classified the impact of an outsourcing strategy into three dimensions: short-term operational impacts (efficiencies, cost savings, productivity, and service levels), mid-term tactical benefits (performance, control, and risk sharing), long-term strategic impacts (core competencies, and learning competencies). Subsequently our previous work [9] investigated the offshore/on-site teams' partnership quality, and evaluated GSD project outcome based on tactical as well as operational benefits from the service provider perspective in India.

Many studies have emphasized the importance of partnership quality in IS outsourcing. In our previous work, we analyzed the results from on-going relationship of offshore/on-site teams' partnership qualities towards the GSD project outcome from the service provider perception [8, 9]. The previous studies [2, 12] have evaluated the IT outsourcing via social, economic, strategic benefits of organizations. Many researchers [4, 13–18] have investigated that knowledge sharing, trust and commitment as key determinants of outsourcing success. In addition, many studies has emphasized the significance of software requirements knowledge transfer to ensure the software quality and customer satisfaction [19, 20]. The previous study reveals the factors that are associated with the social exchange aspect of individual's knowledge sharing behavior based on inter-personal interaction (social interaction) [12, 21]. In addition, previous study addressed interpersonal trust has high relevant factors that affect the knowledge sharing behavior [22, 23]. Moreover the earlier studies have reported the impact of organizational commitment towards knowledge sharing behavior among the employees. Consequently, Ko [24] measured the knowledge transfer based on knowledge dimension (absorptive capacity, shared understanding, arduous relationship).

Based on the above arguments our earlier research [8, 9] measured the GSD project outcome/success from the service provider perspective through offshore/on-site teams' partnership quality factors via four main factors namely: knowledge sharing, trust, team commitment, knowledge transfer and six sub factors that includes: social interaction, interpersonal trust, organizational commitment, absorptive capacity, arduous relationship, and shared understanding. Further our earlier work [9] evaluated the offshore/on-site teams' partnership quality and GSD project outcome with the help of conventional statistical methodologies. However, statistical methods have limitations to deal with people's uncertainty and subjectivity vagueness to determine the offshore/on-site teams' partnership quality in the context of GSD project outcome. To resolve such issues, this study proposes a methodology based on the FMCDM to assist the organizations is classifying the key factors affecting GSD project outcome, and predicted GSD project outcome values are obtained to facilitate an organization to determine the impact of offshore/on-site teams' partnership quality towards success of GSD project outcome otherwise initiate actions to improve the GSD project outcome.

Section 2 briefly describes the FMCDM methodology and Section 3 discusses proposed methodology based on FMCDM. The empirical study of factors affecting GSD project outcome in India is presented in Section 4. Finally, findings and conclusion are presented in Section 5 and Section 6.

2. Concept of fuzzy multi-criteria decision making approach (FMCDM)

The fuzzy multi-criteria decision making approach is a powerful tool for decision makers that has been widely used for selecting, evaluating and ranking problems according to their weights of a finite set of criteria (usually conflicting criteria). Recently, FMCDM has been adopted in selection, evaluation, ranking in the solutions of prediction or forecasting [25]. In addition, the number of studies [25–28] exploited FMCDM for the evaluation of multiple attributes and especially dealing with uncertainty and vagueness within the decision making process by the use of fuzzy set theory. Tsung [25] presented FMCDM for measuring the possibility of successful knowledge management implementation in Taiwan semiconductor Engineering Corporation. Moreover, Yi-Chung [26] applied FMCDM to find critical criteria for evaluating electronic service quality of internet banking in Taiwan domestic banks. In addition, Buyukozkan [27] utilized FMCDM for measuring the performance of software development projects. Consequently, Ming-Shin [28] proposed FMCDM for evaluating the performances of intercity public transport system. Based on this literature studies, our study extend the FMCDM framework to effectively assess the offshore/on-site teams' partnership quality dimensions, underlying influential factors and their impacts on success

of GSD project outcome under fuzzy environment.
The proposed framework operational procedure is summarized as follows:

Step 1: The respondents' subjective decisions use the linguistic variables (shown in Table 1) for the importance weights to evaluate the significance of each constructs, as presented in Table 3.

Step 2: The respondents' subjective decisions use the linguistic variables (shown in Table 2) to assess the rating of each influential factors. The results are shown in Table 4.

Step 3: The linguistic evaluation (shown in Table 3) is converted into triangular scale fuzzy numbers, to create the fuzzy decision matrix and determine the fuzzy weight of each factors by using (3)–(6) as shown in Table 3.

Step 4: The linguistic evaluation (shown in Table 4) is converted into triangular scale fuzzy numbers, to create the fuzzy decision matrix and determine the fuzzy ratings of each factors by using (7)-(9) as shown in Table 4.

Step 5: The weighted performance interval-valued fuzzy decision matrix is constructed by using (5) as shown in Table 3.

Step 6: Best Non-fuzzy Performance values BNP_{W_j} and BNP_{Q_j} of all constructs are determined by using (5) and (9) as shown in Table 3 and Table 4.

Step 7: The values of R_j and Q_j of each respondent is computed by using (6) and (9). After the values of R_j and Q_j have been calculated, we can obtain the P_{outcome} values by using (10), as shown in Table 5.

2.1. Fuzzy set theory

For any fuzzy set, (let's say) A, the function μ_A represents the membership function for which $\mu_A(x)$ indicates the degree of membership that x, of the universal set X, belongs to set A and is, usually, expressed as a number between 0 and 1 that is,

$$\mu_A(x) : X \to [0, 1] \tag{1}$$

$$\mu_A(x) = \left\{ \begin{array}{ll} 0 & \text{if } x \leq 1 \\ \frac{x-l}{m-l} & \text{if } l \leq x \leq m \\ \frac{u-x}{u-m} & \text{if } m \leq x \leq u \\ 0 & \text{if } x \geq u \end{array} \right\} \tag{2}$$

In the Figure 1 (**l**, **m**, **u**) denotes the x coordinates of the three vertices of $\mu_A(x)$ in a fuzzy set A (l: lower boundary and u: upper boundary where membership degree is zero, m: the centre where membership degree is 1).

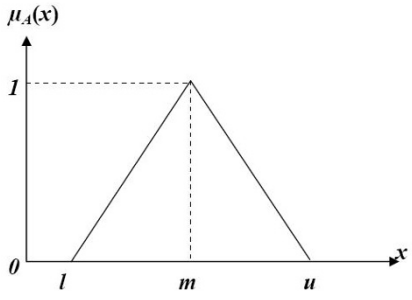

Figure 1. Membership functions of triangular fuzzy number μ_A.

Table 1. Linguistic scale for importance weights of offshore/on-site teams' partnership quality influential factors.

Linguistic scale	Corresponding TFN
Strongly agree	(0.9, 1.0, 1.0)
Agree	(0.7, 0.9, 1.0)
Neither agree nor disagree	(0.3, 0.5, 0.7)
Disagree	(0.0, 0.1, 0.3)
Strongly disagree	(0.0, 0.0, 0.1)

2.2. Linguistic variables

Many studies have stated that the uncertainty and subjective vagueness of human thoughts dealt with fuzzy theory [12, 29] as a result linguistic scale suggested a practical means of relating such situations. For this reason, this study incorporates the fuzzy set theory to measure the performance (offshore/onsite teams' partnership quality, GSD project outcome) by evaluating the subjective decisions of respondents. Moreover, this study has also employed the five linguistic scales to measure the importance weights of offshore/on-site teams' partnership quality influential factors, rating GSD project outcome/success with respect to offshore/onsite teams' partnership quality and their corresponding triangular fuzzy number (TFN) are listed in Table 1 and Table 2.

Table 2. Linguistic terms to rate the GSD project outcome/success with respect to offshore/on-site teams' partnership quality factors.

Linguistic scale	Corresponding TFN
Extremely likely	(0.9, 1.0, 1.0)
Likely	(0.7, 0.9, 1.0)
Medium	(0.3, 0.5, 0.7)
Unlikely	(0.0, 0.1, 0.3)
Extremely unlikely	(0.0, 0.0, 0.1)

3. Framework for evaluating offshore/on-site teams' partnership quality towards GSD project outcome

This study proposed FMCDM framework to measure the offshore/on-site teams' partnership quality dimensions and the underlying influential factors through literature reviews to quantify the outcome/success of GSD projects as shown in Figure 2. Our proposed FMCDM approach for evaluating offshore/on-site teams' partnership quality and GSD project outcome comprises four subsections:

1. Analyzing the offshore/on-site teams' partnership quality influential factors on GSD project outcome.
2. Determining the priority weights of offshore/onsite teams' partnership quality influential factors.
3. Find the possible rating of GSD project outcome with respect to offshore/on-site teams' partnership quality.
4. Obtaining the evaluated values and their impacts on GSD project outcome/success.

3.1. Classify the offshore/on-site teams' partnership quality factors affecting GSD Project Outcome

Our study captures the offshore/on-site teams' partnership quality influential factors through literature reviews. From this, we have classified the eleven main factors that include knowledge sharing, trust, team commitment, knowledge transfer, social interaction, interpersonal trust, organizational commitment, absorptive capacity, arduous relationship, shared understanding and GSD project outcome. From these factors, 38 influential factors have been derived towards the outcome/success of GSD project from service provider perspective into three dimensions: service quality, cost improvement, and schedule. Figure 3 shows the hierarchical structure of determining the offshore/on-site teams' partnership quality influential

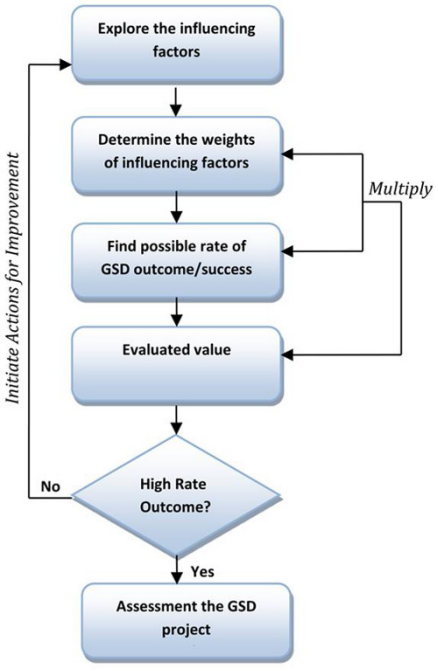

Figure 2. The procedures to assessing offshore/on-site teams' partnership quality towards GSD project outcome.

factors towards GSD project outcome. The partnership quality factors are summarized as follows:

Knowledge sharing (C_1)

C_{11}: clear vision to solve their professional problems towards the GSD project outcome; C_{12}: clear objective to initiate the project in GSD environment; C_{13}: motivation to share knowledge among team members; C_{14}: specialty and knowledge creation ability among teams [9, 25, 30, 31].

Trust (C_2)

C_{21}: team members understanding their roles in GSD project; C_{22}: understanding the project requirements; C_{23}: flexibility and beneficial decisions among teams C_{24}: team members ability to provide assistance [9, 25, 31, 32].

Team commitment (C_3)

C_{31}: feeling of togetherness or closeness among team members C_{32}: mutual coordination among team members; C_{33}: persistent, conscientious responsiveness towards the project outcome; C_{34}: establishing pertinent information towards the project outcome [9, 25, 33, 34].

Knowledge transfer (C_4)

C_{41}: knowledge incentive towards client business process and project outcome; C_{42}: evaluation of project requirements; C_{43}: participation, acceptance and learning incentive of innovative technology; C_{44}: build up a pilot knowledge between teams; C_{45}: learning, and sharing the work materials of employees [9, 24, 25, 34, 35].

Social interaction (C_5)

Three influential factors included in this aspect. They are: C_{51}: social relationship in GSD environment; C_{52}: invigorate sharing knowledge among teams; C_{53}: participation in helping each other [9, 25, 31, 36].

Interpersonal trust (C_6)

C_{61}: evenhanded in negotiations among team members; C_{62}: faith and interest of employees C_{63}: trust relationship among teams [9, 37, 38].

Organizational commitment (C_7)

C_{71}: personal attachment and support towards organization; C_{72}: employee attitude and recognition towards organization; C_{73}: brainstorming actions for organizations [9, 14, 25, 39].

Absorptive capacity (C_8)

C_{81}: capacity to absorb technical knowledge; C_{82}: capacity to absorb business knowledge; C_{83}: participation and support to solve issues; C_{84}: understanding the goals, task and responsibilities over the client's business process [9, 24, 40].

Arduous relationship (C_9)

C_{91}: arduous relationship among team members; C_{92}: participation and communication relationship; C_{93}: cooperation towards project outcome [9, 24, 25, 41].

Shared understanding (C_{10})

C_{101}: understand the process with respect to the implementation; C_{102}: mutual understanding towards the process; C_{103}: explicit and standard communication pattern in GSD environment [9, 24, 25, 41].

GSD project outcome (C_{11})

C_{111}: evaluating the project quality with respect to the service. C_{112}: assessment project time and schedule; C_{113}: cost improvement for establishing the client's business process; C_{114}: project functionality towards client's business process [2, 9, 25, 35, 42].

3.2. Determination of the importance weights of influential factors (partnership quality) by FMCDM approach

(1) Create a decision matrix $\tilde{A}$ for the importance weights of offshore/on-site teams' partnership quality influential factors (C_j, $j = 1, 2, 3, \ldots, n$). The respondents R^i, $i = 1, 2, 3, \ldots, m$ were asked to share their subjective judgments about the importance weights of each partnership quality factors by using linguistic scales (as listed in Table 1) The decision matrix $\tilde{A}$ as follows

$$\begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ \vdots \\ C_n \end{array} \begin{array}{c} \begin{array}{cccccc} R^1 & R^2 & R^3 & \cdots & R^m \end{array} \\ \begin{bmatrix} \tilde{a}_1^1 & \tilde{a}_1^2 & \tilde{a}_1^3 & \cdots & \tilde{a}_1^m \\ \tilde{a}_2^1 & \tilde{a}_2^2 & \tilde{a}_2^3 & \cdots & \tilde{a}_2^m \\ \tilde{a}_3^1 & \tilde{a}_3^2 & \tilde{a}_3^3 & \cdots & \tilde{a}_3^m \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \tilde{a}_n^1 & \tilde{a}_n^2 & \tilde{a}_n^3 & \cdots & \tilde{a}_n^m \end{bmatrix} \end{array}, \; i = 1, 2, \ldots, m; \; j = 1, 2, \ldots, n \tag{3}$$

In this decision matrix where m denotes the number of respondents and n is the number of influential factors, and $\tilde{a}_j^i = (La_j^i, Ma_j^i, Ua_j^i)$ represents the fuzzy degree of impact assessed by i^{th} respondents for j^{th} influential factor.

(2) The subjective assessments of each respondent differ with respect to their experience and knowledge, our study employs the average score method shown in (4), to incorporate the fuzzy performance values of m respondents.

$$\tilde{\omega}_j = \frac{1}{m}\left[\sum_{i=1}^{m} \tilde{a}_j^i\right] \tag{4}$$

Here $\tilde{\omega}_j = (L\omega_j, M\omega_j, U\omega_j)$ denotes the synthesized fuzzy importance weight of j^{th} influential factor.

(3) Subsequent to defuzzification process the aggregated triangular fuzzy numbers into best non-fuzzy performance (BNP) values, BNP_{W_j} is taken to denote the BNP values for the triangular fuzzy number $\tilde{\omega}_j$ can be produced through (5)

$$BNP_{W_j} = \frac{[(U\omega_j - L\omega_j) + (M\omega_j - L\omega_j)]}{3} + L\omega_j \tag{5}$$

Here W_j is the importance weight of j^{th} influential factor in crisp numbers format.

(4) After the defuzzification of triangular fuzzy numbers, crisp numbers are collected and normalized. Here R_j to indicate the normalized importance weight of j^{th} influential factor can be computed via (6)

$$R_j = \frac{W_j}{\sum_{j=1}^{n} W_j} \tag{6}$$

where $\sum_{j=1}^{n} R_j = 1$.

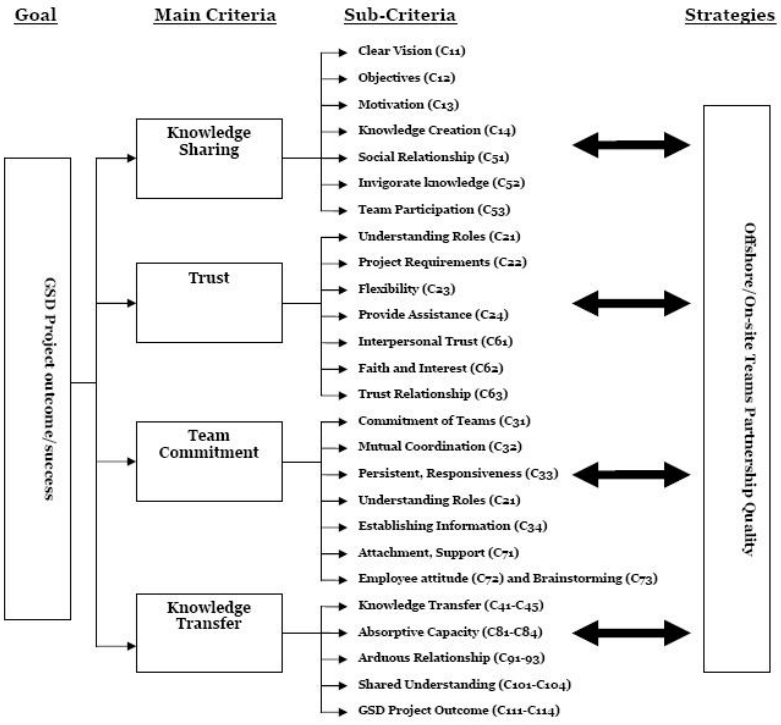

Figure 3. The hierarchy structure for evaluating offshore/on-site teams partnership quality towards GSD project outcome.

3.3. Obtaining the possible rating of GSD project success/outcome by FMCDM

(1) The respondents R_i, $i = 1, 2, 3, \ldots, n$ were asked to share their perception towards GSD project outcome with respect to each influential factor C_j, $j = 1, 2, 3, \ldots, n$ by using linguistic scales (as shown in Table 2). The decision matrix $\tilde{B}$ is defined as

$$\begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ \vdots \\ C_n \end{array} \begin{array}{c} \begin{array}{cccccc} R^1 & R^2 & R^3 & \cdots & R^m \end{array} \\ \begin{bmatrix} \tilde{b}_1^1 & \tilde{b}_1^2 & \tilde{b}_1^3 & \cdots & \tilde{b}_1^m \\ \tilde{b}_2^1 & \tilde{b}_2^2 & \tilde{b}_2^3 & \cdots & \tilde{b}_2^m \\ \tilde{b}_3^1 & \tilde{b}_3^2 & \tilde{b}_3^3 & \cdots & \tilde{b}_3^m \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \tilde{b}_n^1 & \tilde{b}_n^2 & \tilde{b}_n^3 & \cdots & \tilde{b}_n^m \end{bmatrix} \end{array}, \quad i = 1, 2, \ldots, m;\ j = 1, 2, \ldots, n \tag{7}$$

In this decision matrix m denotes the number of respondents and n is the number of influential factors, $\tilde{b}_j^i = (Lb_j^i, Mb_j^i, Ub_j^i)$ represents the fuzzy possible rating of GSD project outcome assessed by i^{th} respondents with respect to the j^{th} influential factor.

(2) The opinions of various respondents are obtained in order to get the aggregated fuzzy possible rating of GSD project outcome. Our study employs the average value method as shown in (8), to incorporate the fuzzy judgment values of m respondents.

$$\tilde{q}_j = \frac{1}{m}\left[\sum_{i=1}^{m} \tilde{b}_j^i\right] \tag{8}$$

Here $\tilde{q}_j = (Lq_j, Mq_j, Uq_j)$ denotes the synthesized fuzzy possible rating of GSD project outcome, with respect to the j^{th} influential factor.

(3) Subsequent to defuzzification process the aggregated triangular fuzzy numbers is converted into best non-fuzzy performance (BNP) values, BNP_{Q_j} is taken to denote the BNP value for the triangular fuzzy number $\tilde{q}_j$ can be produced through (9).

$$BNP_{Q_j} = \frac{[(Uq_j - Lq_j) + (Mq_j - Lq_j)]}{3} + Lq_j \tag{9}$$

Here Q_j denotes the possible rating of GSD project outcome/success with respect to the j^{th} influential factor in crisp numbers format.

3.4. Determining the outcome of GSD project success

Once the importance weights of partnership quality influential factors and possible rating of GSD project outcome are determined, importance weights of influential factors and possible rating GSD project outcome/success are multiplied, computed as shown in (10), and then we can obtain a predicted value (P_{outcome}) for GSD project outcome.

$$P_{\text{outcome}} = \sum_{j=1}^{n} R_j Q_j \tag{10}$$

Here R_j denotes the normalized importance weight of j^{th} influential factors where Q_j indicates the possible rating of GSD project outcome with respect to the j^{th} influential factor.

4. Empirical study to evaluate the partnership quality influential factors towards outcome of GSD project

Accordingly, the market volume has been increasing in the recent years, with India becoming the most popular offshore destination [35]. Offshore and on-site teams have contributed significantly in the development effort to deal with global customers. The on-site teams work from the client location, understand and audit the client's requirements where an offshore team, operating from India, executes the requirement based on the inputs provided by the on-site teams [9]. Moreover, huge number of companies using information system offshore is not fulfilled with the substantial outcome [35]. For this motivation, in our earlier research [9] we have investigated that Indian software service providing companies make sure the successful outcome of GSD projects on the basis of assessing the offshore and on-site team's partnership quality.

In our earlier work [8, 9], we have utilized survey research methods based on the data collected from 338 software professionals' to assess offshore/on-site teams' partnership quality towards the outcome of GSD projects in India. In the present study, involves thirty-eight comprehensive offshore/on-site teams' partnership quality factors for GSD projects via systematic literature review are taken into account and to extend our earlier work [8, 9]. The data in this paper was normalized using min-max normalization [43]. Min-max normalization is linear scaling algorithm. It transforms the original input range into new data range (typically 0-1). To evaluate the GSD project outcome this study comprises of three groups: Executive committee (comprising two person consisting project board, project manager), solution development teams (comprising three person including user team leader, application team leader, technical team leader) and solution delivery teams (comprising three person including process specialist, solution architect, technical writer). Thus, this study tested with 20 offshore/on-site experts belongs to above groups in India to reveal the offshore/on-site teams' partnership quality in the context of GSD project outcome.

4.1. Calculation of importance weights of each influential factor (partnership quality) by FMCDM

Each partnership quality dimension (knowledge sharing, trust, team commitment and knowledge transfer) is divided into 3 to 5 factors; comprising 38 influential factors (see Figure 3) are investigated for the outcome of GSD projects. Weightings for these 38 factors are obtained through empirical study with the 20 offshore/on-site project representatives. The following steps elucidate the computational procedure involved in obtaining the importance weights of each influential factor using the FMCDM approach:

Step 1 The respondents' subjective decisions use the linguistic variables (as shown in Table 1) for the importance weights to evaluate the influence of each constructs, as presented in Table 3.

Step 2 The linguistic variables are converted into triangular scale fuzzy numbers (as shown in Table 3). Create the fuzzy decision matrix and determine the fuzzy weight of each factor by using (3)–(6) as shown in Table 3.

Step 3 Since the subjective thoughts of the respondents are different, there is a need to aggregate their opinion towards the importance weights of each influential factor by using (4) as shown in Table 3.

Step 4 Best Non-fuzzy Performance values BNP_{W_j} and BNP_{Q_j} of all constructs are determined by using (5), (9). Defuzzifying each aggregated fuzzy number into a crisp value for ranking of influential factors to further calculation shown in Table 3 and Table 4.

Step 5 After the defuzzification of triangular fuzzy numbers, crisp numbers are collected and normalized the importance weights of influential factors, as listed in Table 3.

Table 3. Corresponding TFNs of partnership quality factors weight.

	R1	R2	R3	R4	R5	R6	R7
C11	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C12	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C13	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C14	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C21	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C22	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C23	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C24	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C31	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)
C32	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C33	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C41	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C42	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.0,0.0,0.1)	(0.0,0.0,0.1)
C43	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.0,0.0,0.1)	(0.0,0.0,0.1)
C44	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C45	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C51	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5.0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C52	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5.0.7)	(0.3,0.5.0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C53	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5.0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C61	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C62	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C63	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C71	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5.0.7)	(0.0,0.1,0.3)
C72	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5.0.7)	(0.0,0.1,0.3)
C73	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5.0.7)	(0.0,0.1,0.3)
C81	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C82	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C83	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.3,0.5.0.7)	(0.7,0.9,1.0)
C91	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C92	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C93	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C101	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5.0.7)	(0.7,0.9,1.0)
C102	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C103	(0.3,0.5.0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5.0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C111	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C112	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C113	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C114	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)

(continued)

	R8	R9	R10	R11	R12	R13	R14
C11	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C12	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C13	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C14	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C21	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.0,0.1,0.3)
C22	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.0,0.1,0.3)
C23	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.0,0.1,0.3)
C24	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.0,0.1,0.3)
C31	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C32	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C33	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C41	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)
C42	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C43	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C44	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)
C45	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)
C51	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9.1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.9,1.0,1.0)
C52	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9.1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9.1.0)	(0.9,1.0,1.0)
C53	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.7,0.9.1.0)	(0.9,1.0,1.0)
C61	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)
C62	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)
C63	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)
C71	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.1,0.3)
C72	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.0,0.1,0.3)
C73	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.0,0.1,0.3)
C81	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)
C82	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)
C83	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9.1.0)
C91	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)
C92	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)
C93	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)
C101	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.0,0.1,0.3)
C102	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.0,0.1,0.3)
C103	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.0,0.1,0.3)
C111	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C112	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C113	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C114	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)

(continued)

	R15	R16	R17	R18	R19	R20	$\tilde{\omega}_j$	W_j
C11	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9.1.0,1.0)	(0.86,0.97,0.99)	0.938
C12	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.89,0.99,1.00)	0.962
C13	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.89,0.99,1.00)	0.962
C14	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.89,0.99,1.00)	0.962
C21	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,0.1)	(0.70,0.85,0.92)	0.820
C22	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,0.1)	(0.70,0.85,0.92)	0.820
C23	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,0.1)	(0.70,0.85,0.92)	0.820
C24	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,0.1)	(0.69,0.85,0.93)	0.820
C31	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.73,0.85,0.91)	0.827
C32	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.74,0.86 0.91)	0.832
C33	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.77,0.90,0.94)	0.868
C41	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.75,0.88,0.93)	0.848
C42	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.72,0.85,0.91)	0.825
C43	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.72,0.85,0.91)	0.825
C44	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.72,0.85,0.91)	0.825
C45	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.75,0.88,0.93)	0.848
C51	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.50,0.68,0.82)	0.667
C52	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.62,0.79,0.90)	0.768
C53	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.65,0.81,0.90)	0.783
C61	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.86,0.98,1.00)	0.947
C62	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.86,0.98,1.00)	0.947
C63	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.86,0.98,1.00)	0.947
C71	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.75,0.86,0.90)	0.837
C72	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.71,0.83,0.89)	0.808
C73	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.74,0.86.0.90)	0.832
C81	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.81 0.95,0.99)	0.822
C82	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.77,0.92,0.97)	0.822
C83	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.81,0.95,0.99)	0.775
C91	(0.7,0.9.1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.69,0.85,0.94)	0.913
C92	(0.7,0.9.1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.3,0.5,0.7)	(0.71,0.87,0.95)	0.885
C93	(0.7,0.9.1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9.1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.68,0.85,0.94)	0.913
C101	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.3,0.5,0.7)	(0.7,0.9.1.0)	(0.75,0.85 0.88)	0.823
C102	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.3,0.5,0.7)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.75 0.85 0.88)	0.842
C103	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.7,0.9.1.0)	(0.69,0.80,0.85)	0.818
C111	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.85,0.97,0.99)	0.933
C112	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.80,0.92 0.96)	0.892
C113	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.82,0.94,0.97)	0.910
C114	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.85,0.97,0.99)	0.933
Total								28.507

4.2. Calculate possible rating of GSD project outcome with respect to offshore/on-site teams' partnership quality influential factors

The possible rating of GSD project outcome with respect to offshore/on-site teams' partnership quality factor is computed as follows:

Step 1 The 20 respondents use the linguistic variables (shown in Table 2) to assess the rating of each factors. The results are shown in Table 4.

Step 2 The linguistic variables are converted into triangular scale fuzzy numbers (as shown in Table 4). The fuzzy decision matrix is created and determines the fuzzy ratings of each factor by using (7)–(9) as listed in Table 4.

Step 3 Since the subjective thoughts of the respondents are different, so aggregate their opinion towards ratings of each influential factors by using (8) as shown in Table 4.

Step 4 Best Non-fuzzy Performance values BNP_{W_j} and BNP_{Q_j} of all constructs are determined by using (5) and (9) for fuzzy possible ratings of GSD project outcome with respect to each influential factor.

Step 5 After the defuzzification of triangular fuzzy numbers, crisp numbers are collected and normalized the rankings of each influential factor, as shown in Table 4.

4.3. Determining the outcome of GSD project success

Compute the values of R_j (normalized importance weights) and Q_j (possible rating of GSD project outcome) of each respondent by using (6) and (9). After the values of R_j and Q_j have been calculated, the P_{outcome} values can be obtained by using (10), as derived in Table 5.

5. Findings and Discussion

Our study reveals the significance (possible ratings) of offshore/on-site teams' partnership quality in four main criteria and 38 influential factors that are summarized in Table 5. Similarly, our results indicate that the offshore/on-site teams participation in helping each other(C_{53}), invigorate sharing knowledge among teams(C_{51}), social relationship in GSD environment(C_{52}), mutual understanding towards the process(C_{102}), specialty and knowledge creation ability among teams(C_{14}), understand the process with respect to the implementation(C_{101}),evaluation of project requirements(C_{42}), participation, acceptance and learning incentive of innovative technology(C_{43}), build up a pilot knowledge between teams(C_{44}), knowledge incentive towards client business process and project outcome(C_{41}), learning, and sharing the work materials of employees(C_{45}), clear objective to initiate the project in GSD environment(C_{12}), are better than those of other partnership quality influential factors towards the GSD project outcome/success. Moreover, team members understanding their roles in GSD project (C_{21}), understanding the project requirements(C_{22}), flexibility and beneficial decisions among teams (C_{23}), team members ability to provide assistance(C_{24}), personal attachment and support towards organization(C_{71}), brainstorming actions for organizations(C_{73}), arduous relationship among team members(C_{91}),these values are smaller than 0.65.

Consequently, this study emphasizes that service provider companies should focus on these factors in order to establish the effective partnership quality of offshore/on-site teams to have a significant impact on GSD project outcome. In addition, the predicted value indicates that the offshore/on-site teams' partnership quality towards the GSD project outcome is 0.79830. That is P_{outcome} values exceed 0.80 which specifies that offshore/on-site teams' partnership quality factors reveal key determinant on GSD project outcome/success.

6. Conclusion

Improving the customer service quality, shortening the development cost and schedule are mentioned as objectives for motivating GSD project outcome initiatives, thus assessing offshore/on-site teams partnership quality towards GSD project outcome at Indian software organizations. This study suggests a framework based on the FMCDM approach for evaluating the offshore/on-site teams' partnership quality towards the outcome of GSD projects. Our findings show that offshore/on-site teams' partnership quality has significant effect on GSD project outcome. Our earlier research [9] used the traditional likert scale for evaluating the offshore/on-site team partnership quality. The likert scale cannot deal with cognitive uncertainty arising from human thinking and perception process [26]. Therefore, this study focused on uncertainty and subjective vagueness within the decision making process dealing with fuzzy set theory. The linguistic terms measured using triangular fuzzy numbers are used to find out the importance weights of partnership

Table 4. Translated TFNs of possible ratings for GSD project outcome.

	R1	R2	R3	R4	R5	R6	R7
C11	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C12	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C13	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C14	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C21	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C22	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C23	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.9,1.0,1.0)
C24	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.9,1.0,1.0)
C31	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C32	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)
C33	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C41	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C42	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C43	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C44	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C45	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C51	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C52	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)
C53	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C61	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C62	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C63	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C71	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C72	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C73	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.0,0.1,0.3)	(0.7,0.9,1.0)	(0.0,0.1,0.3)
C81	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C82	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C83	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C91	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C92	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)
C93	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C101	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C102	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)
C103	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C111	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C112	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C113	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C114	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)

(continued)

	R8	R9	R10	R11	R12	R13	R13
C11	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C12	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C13	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C14	(0.9,1.0,1.0)	(0.0,0.0,0.1)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C21	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.0,0.0,0.1)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C22	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C23	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C24	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C31	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C32	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C33	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C41	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C42	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C43	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C44	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C45	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C51	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C52	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C53	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C61	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C62	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C63	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C71	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C72	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C73	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.3,0.5,0.7)	(0.7,0.9,1.0)
C81	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C82	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)
C83	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.9,1.0,1.0)
C91	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C92	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C93	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C101	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)
C102	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C103	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.0,0.1,0.3)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)
C111	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)
C112	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C113	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)
C114	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)

(continued)

	R15	R16	R17	R18	R19	R20	$\tilde{q}_j$
C11	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.56,0.75,0.88)
C12	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.79 0.90 0.93)
C13	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.82,0.92,0.94)
C14	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.73,0.85,0.90)
C21	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.85,0.95,0.96)
C22	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.39,0.58,0.74)
C23	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.42,0.61,0.77)
C24	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.45,0.63,0.79)
C31	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.46,0.65,0.81)
C32	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.68,0.83,0.91)
C33	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.69,0.84,0.91)
C41	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.73,0.88,0.94)
C42	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.76,0.93,1.00)
C43	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.76,0.93,1.00)
C44	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.76,0.93,1.00)
C45	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.75,0.93,1.00)
C51	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.76,0.93,1.00)
C52	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.84,0.96,0.99)
C53	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.87,0.99,1.00)
C61	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.65,0.85,0.96)
C62	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.68,0.87,0.97)
C63	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.68,0.87,0.97)
C71	(0.0,0.1,0.3)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.39,0.58,0.75)
C72	(0.0,0.1,0.3)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.49,0.68,0.83)
C73	(0.0,0.1,0.3)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.40,0.57,0.72)
C81	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.76,0.91,0.97)
C82	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.73,0.89,0.96)
C83	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.76,0.91,0.97)
C91	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.44,0.63,0.79)
C92	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.51,0.69,0.83)
C93	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.7,0.9,1.0)	(0.9,1.0,1.0)	(0.9,1.0,1.0)	(0.56,0.75,0.88)
C101	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.80,0.94,0.99)
C102	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.82,0.96,1.00)
C103	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.9,1.0,1.0)	(0.3,0.5,0.7)	(0.75,0.90,0.96)
C111	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.57,0.76,0.88)
C112	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.59,0.78,0.90)
C113	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.58,0.77,0.90)
C114	(0.7,0.9,1.0)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.7,0.9,1.0)	(0.3,0.5,0.7)	(0.3,0.5,0.7)	(0.61,0.80,0.91)

Table 5. Importance weights of partnership quality influential factors, possible rating of outcome and prediction possibility of GSD project outcome.

Constructs	Weight of factor with in the aspect	Weight of factor across aspect R_j	Possible rating Q_j	Prediction Possibility $P_{outcome}$
C1: 0.1173				
C11	0.2458 [4]	0.0288 [5]	0.8683 [14]	0.0250 [3]
C12	0.2519 [1]	0.0295 [1]	0.8917 [10]	0.0263 [2]
C13	0.2519 [1]	0.0295 [1]	0.8217 [20]	0.0242 [8]
C14	0.2505 [3]	0.0295 [1]	0.9150 [5]	0.0270 [1]
C2: 0.1004				
C21	0.1726 [4]	0.0251 [26]	0.5683 [36]	0.0143 [38]
C22	0.2216 [2]	0.0251 [26]	0.5967 [34]	0.0150 [36]
C23	0.2227 [1]	0.0251 [26]	0.6200 [32]	0.0156 [33]
C24	0.2216 [2]	0.0251 [26]	0.6383 [31]	0.0160 [32]
C3: 0.0774				
C31	0.2230 [3]	0.0253 [19]	0.8067 [23]	0.0204 [27]
C32	0.2241 [2]	0.0255 [18]	0.8117 [22]	0.0207 [24]
C33	0.2317 [1]	0.0266 [13]	0.8483 [17]	0.0226 [9]
C4: 0.1279				
C41	0.2276 [1]	0.0260 [14]	0.8917 [10]	0.0232 [11]
C42	0.2167 [4]	0.0253 [19]	0.8967 [7]	0.0227 [16]
C43	0.2167 [4]	0.0253 [19]	0.8967 [7]	0.0227 [16]
C44	0.2227 [3]	0.0253 [19]	0.8967 [7]	0.0227 [16]
C45	0.2276 [1]	0.0260 [14]	0.8917 [10]	0.0232 [11]
C5: 0.0680				
C51	0.1891 [3]	0.0204 [35]	0.9283 [2]	0.0190 [28]
C52	0.2106 [2]	0.0236 [34]	0.9283 [2]	0.0219 [21]
C53	0.2139 [1]	0.0240 [32]	0.9517 [1]	0.0229 [14]
C6: 0.0870				
C61	0.2474 [1]	0.0290 [4]	0.8167 [21]	0.0237 [9]
C62	0.2474 [1]	0.0290 [4]	0.8400 [18]	0.0244 [6]
C63	0.2464 [3]	0.0290 [4]	0.8400 [18]	0.0244 [6]
C7: 0.0760				
C71	0.2251 [1]	0.0257 [17]	0.5733 [35]	0.0147 [37]
C72	0.2241 [2]	0.0248 [31]	0.6650 [30]	0.0165 [31]
C73	0.2241 [2]	0.0255 [18]	0.5600 [37]	0.0143 [38]
C8: 0.0831				
C81	0.2084 [3]	0.0280 [8]	0.8800 [13]	0.0246 [4]
C82	0.2344 [1]	0.0271 [12]	0.8567 [16]	0.0232 [11]
C83	0.2131 [2]	0.0280 [8]	0.8800 [13]	0.0246 [4]
C9: 0.0761				
C91	0.2408 [1]	0.0252 [23]	0.6150 [33]	0.0155 [34]
C92	0.2351 [2]	0.0258 [16]	0.6750 [29]	0.0174 [30]
C93	0.2408 [1]	0.0251 [26]	0.7250 [28]	0.0182 [29]
C10:0.0742				
C101	0.2234 [2]	0.0252 [23]	0.9083 [6]	0.0229 [14]
C102	0.2262 [1]	0.0252 [23]	0.9267 [4]	0.0233 [10]
C103	0.2213 [3]	0.0238 [33]	0.8667 [15]	0.0206 [25]
C11:0.1124				
C111	0.2494 [1]	0.0286 [6]	0.7350 [27]	0.0210 [22]
C112	0.2364 [4]	0.0273 [11]	0.7533 [25]	0.0206 [25]
C113	0.2401 [3]	0.0279 [10]	0.7483 [26]	0.0209 [23]
C114	0.2448 [2]	0.0286 [6]	0.7717 [24]	0.0221 [20]

quality influential factors and the rating of GSD project outcome.

The partnership quality dimensions are derived from the respondents' subjective perception for the GSD project outcome. This forms the basis for this empirical study on the offshore software development, maintenance project at Indian software companies. In this study one of the limitations must be acknowledged. Our study investigated the offshore/on-site teams' partnership quality factors in the context of GSD projects outcome from the service provider perspective where as earlier studies [2–4, 6] addressed the partnership quality factors from client and outsourcing service provider point of view in a mature relationship.

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