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Facility Location Selection for B-Schools in Indian Context: A Multi-Criteria Group Decision Based Analysis

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Abstract: Facility location is one of the critical strategic decisions for any organization. It not only carries the organization's identity but also connects the point of origin and point of consumption. In the case of higher educational institutions, specifically B-Schools, location is one of the primary concerns for potential students and their parents while selecting an institution for pursuing higher education. There has been a plethora of research conducted to investigate the factors influencing the B-School selection decision-making. However, location as a standalone factor has not been widely studied. This paper aims to explore various location selection criteria from the viewpoint of the candidates who aspire to enroll in B-Schools. We apply an integrated group decision-making framework of pivot pairwise relative criteria importance assessment (PIPRECIA), and level-based weight assessment LBWA is used wherein a group of student counselors, admission executives, and educators from India has participated. The factors which influence the location decision are identified through qualitative opinion analysis. The results show that connectivity and commutation are the dominant issues.

Keywords: B-School location; pivot pairwise relative criteria importance assessment (PIPRECIA); level-based weight assessment (LBWA); kendall's concordance coefficient

1. Introduction

The selection of facility locations for establishing an operational set up is a crucial decision for organizations. Generally, the maximization of utility and profit are two underlying intents of an organization while selecting a location for setting up its facility. The facility location decision considers broad factors such as economic benefits, ease of operation, serviceability, lead time reduction and functional connectivity with the point of demand and point of supply while optimizing the existing constraints [1–6]. The selection of an appropriate facility location provides a competitive advantage to the organizations, and quite understandably requires a long-term commitment. Hence, location selection is a critical and complex strategic decision that entails the satisfaction of multiple criteria [7].

Over the last few decades, higher education in India has become quite popular. As a result, there has been substantial growth in the number of institutions offering higher education programs. Regarding the management education segment, as per the records of All India Council for Technical Education (AICTE), a regulatory body for technical education in India, the number of institutions offering post-graduate programs in management is 3037 (2019–2020), which was 682 in 1988. However, the closing figure of 2018–2019 suggests that the enrolment to sanctioned intake ratio (ESIR) is only 62.68 percent. Therefore, it is visible that a substantial number of seats are vacant. There is intense competition in the segment of higher education related to business management, as institutes put continuous efforts to differentiate themselves from others for increasing their ESIR [8]. Hence, the higher educational institutions (HEIs) must understand their stakeholders' requirements while designing and delivering their services. In the past, there have been many studies which attempted to find out the considerations of stakeholders such as parents/guardians and students when they select a B-School for pursuing Management studies [9–22]. The researchers [23,24] highlighted various aspects that the potential students and their parents/guardians look into while selecting an institute/university for pursuing higher education. The authors highlighted several factors that influence the final decision to select a B-School, such as physical infrastructure, and a campus visit [15,25]; faculty quality [21,22,25]; international linkage and exposure [20]; the brand image of the HEIs [22]; corporate relation and placement, and the teaching-learning process and course fee [20]; location [20,22]; support infrastructure, and allied services [25]. Some researchers [26–28] have pointed out the socioeconomic factors, such as family background, career goals, and gender, that influence decision-making, while the literature also mentioned the significance of environmental criteria, social influence and imitation behavior in the context of B-School selection [29]. In addition, with the changing requirements for employability, it has been seen in recent years that reputation and financial health of the promoting group, facilities for co- and extra-curricular activities; infrastructure based on the purpose of learning, affordability and career objectives of the aspirants are some of the factors which play a critical role in influencing the B-School selection decision. Eisenberg et al. [30] propounded that cultural intelligence (CQ) is one of the differentiating factors of employability. Therefore, cross-cultural management games and activities are of importance to the potential students.

From our limited search, it is evident that location as a standalone factor has been inadequately addressed by researchers from the perspective of the potential service takers (i.e., students and their parents). However, it has been regarded in previous studies as one of the primary factors that influence the selection of a B-School. In this regard, the present study contributes in the following ways. First, it focuses on the facility location selection problem for setting up a B-School. The objective is to explore the criteria for selecting a location for setting up a B-School as perceived as convenient by the stakeholders. Second, the selection of an effective location for setting up a facility is challenging issue as it depends on multiple objectives which are conflicting in nature [31]. It is required to make a trade-off among the objectives. Hence, the location selection problem is a typical problem for applying multi-criteria decision analysis [32]. In this regard, we address the central issue by using a two-stage integrated opinion-based decision analysis framework. In the first stage, we conduct an exploratory qualitative analysis for identifying the criteria. Next, we derive relative weightage of the criteria by using a novel combined framework of pivot pairwise relative criteria importance assessment (PIPRECIA) and level-based weight assessment (LBWA) algorithms. In a nutshell, this paper presents an interdisciplinary application of multi-criteria based mathematical models for finding out critical criteria related to B-School location selection.

The rest of the paper is presented through the five following sections. In the next section (Section 2), the research framework is sketched out. Further, the descriptions of the criteria are included and the methods are described. Section 3 exhibits the findings of the data analysis, while in Section 4, some of the implications and future agenda are highlighted. Finally, Section 5 concludes the paper.

2. Materials and Methods

In this study, we have used an expert opinion-based group decision-making (EOGDM) approach. For this purpose, we approached seven student counselors (SC). These SCs deal with several students aspiring to pursue higher studies in Business Management and their parents. The SCs belong to different places located in the eastern part of India. Apart from them, we also included three educators/executives (EE). The EEs have substantial experience related to admission in the domain of management education. The final weights of the criteria (indicating their relative) priorities are derived by combining these groups' opinions. The following table (see Table 1) exhibits the profiles of the respondents. Since here, the central issue is specific, a smaller sample size for the respondents is justified [33]. Further, Kendall [34] suggested that the EOGDM method is useful in the sense that an expert represents a substantial sample of respondents. The author recommended a group of a minimum of seven members for carrying out such expert opinion-based analysis. In this study, a total of 10 members have participated. We have carried out this research in two stages.

Stage 1 (Exploration): In the first stage, we have adopted an exploratory approach to note the views of all the respondents related to the primary question: "What is a good location for a B-School?" The objective was to determine the factors or criteria that influence the selection of the location for B-Schools. Based on the opinions of the respondents, we have identified the criteria.

Stage 2 (Comparison): In this stage, we have applied the EOGDM framework for identifying the relative priorities of the criteria as listed. The SCs provide first-hand information based on the students' inquiries during the service encounter. On the other hand, EEs interact with the students after selecting a B-School. Hence, at the EE level, the pairwise comparison is justified, whereas, at the SC level, it is required to have a relative ordering of the criteria according to the prospective candidates' first-hand mind-set. Therefore, for the analysis purposes, a recently developed multi-criteria group decision-making method, such as PIPRECIA [35] has been applied for the EE group (three members). For the SC group (seven members), we have used LBWA [36]. The underlying objective is to determine the weights of the criteria, which necessarily derive the relative usefulness (or importance) of one criterion over the others [37]. Finally, the weights assigned to the criteria by both these groups have been combined to arrive at the global priorities. In effect, the 'point-of-sales' information and mentors' views are interwoven to reach the consensus between both perspectives.

Table 1. Profile of the respondents.

SC		**EE**			
Experience (years)		Experience (years)		Role	
3–5 years	2	8 years	1	Admission Executive	2
6–9 years	3	11 years	1	Professor	1
10 years and more	2	17 years	1		
Total	7	Total	3	Total	3

2.1. Factors Influencing Location Choice for B-School

The facility location decision problem, in general, has been a topic of interest for several researchers and practitioners. There has been a plethora of research work that attempted to determine the criteria for selecting a facility location. Some of the research works are summarized here. Porter (2000) explained the facility location decision-making problem from the perspective of competitive advantage. According to Porter [38], facility location decision considers two primary aspects: (a) economic (such as transportation, availability of labor and other resources, cost, connectivity with the markets and supply base) and (b) qualitative factors (such as linkage with industry clusters for availing spillover demand, open, innovative and connected socio-cultural environment). Ertuğrul and Karakaşoğlu [39] contemplated the issue of location selection from multiple perspectives. According to the authors, an excellent facility location must be in the vicinity of the point of demand, i.e., markets, so that demand–supply balance can be made. Furthermore, for a healthy operating environment, organization and community must coexist based on mutual benefits. While the community perceives organization for earning and developmental support, organizations look for resources, utilities, and necessary facilities. For ensuring quality of life, it is equally important to focus on recreational activities and healthcare. Therefore, the availability of amusement facilities, fitness centers, and enjoyable shopping opportunities is of notable importance in location selection. Transportation facilities and costs also need to be given due consideration [39]. In addition to the factors mentioned so far, Farahani et al. [4] mentioned the significance of environmental risk, disruption risk, and political stability in deciding to set up a facility at a particular location. The study of Dogan [40] put forth the importance of quality of life in site selection. Some researchers [41,42] considered the sustainability factors in the location selection problem. In two recent studies, the researchers [43,44] emphasized long-term thinking to take up the facility location selection decision. They argued that factors including the image of the location, familiarity with the place, distance, and economic consideration (i.e., cost) need to be pondered. Hence, the facility location selection problem involves multiple criteria, wherein a rational trade-off needs to be done. From the literature, it is evident that several researchers have used multi-criteria decision-making frameworks to address this issue [31,32,41,45–52]. In line with the opinions of the researchers, we attempted to identify the criteria for facility location selection for a B-School based on the views of the students and their parents. As their representatives, we took feedback from the SCs and EEs. The opinions are summarized in the following table (see Table 2). Based on the respondents' opinions, the criteria for B-School location selection are derived (see Table 3).

Table 2. Summary of respondents' opinions and identified factors.

Respondent	Narration	Codes (Identified Factors)
Respondent 1:	"Location of B-Schools is important as it helps in increased connectivity B-Schools must be located in the main city but not in a noisy place Students should be able to commute, i.e., transportation should be available it should be located near to metro stations, bus stops etc. Travelling in night won't be a problem Students can avail facilities like medical stores, grocery stores easily."	Connectivity; Noise; Transport; Safety; Medical services; Closeness to market
Respondent 2:	"Students should be able to commute easily time to reach the campus (if it is non-residential) should be very less the place must be safe during the night also close to the market."	Commutation; Travelling time; Closeness to market; Safety
Respondent 3:	"Location of the B-School is very important because if it is located at a good place, say in the heart of the city, it attracts the student the factors which need to be kept in mind are nearness to the metro city, different companies (employers), local market, popular places."	Connectivity; Closeness to employers, markets
Respondent 4:	"the travelling cost for non-residential students or for a non-residential facility needs to be considerably less if the B-schools are located in such areas where there are less number of companies or there is a reluctance of the companies to visit the campus, then it may create serious problems for employment/final placements and internships for any kind of inter-college linkage, it is important for the B-schools to be located in the college areas it is equally important to have nearby places where students can spend time beyond the class hours for relaxation."	Cost of travel; Closeness to employers; Connectivity; Quality of life
Respondent 5:	"Access to the employers and professionals of the target industries is very crucial. If the location is appropriate then good employers will visit the campus there must be a possibility for setting up good infrastructure quality of life is another important factor."	Closeness to employers; Quality of life
Respondent 6:	"the place should be well accessible there should not be a problem for building familiarity with the local languages and culture, i.e., cultural barrier should not be there environment must be less polluted."	Commutation; Familiarity with local language and culture; Pollution
Respondent 7:	"nowadays internet access is mandatory. Hence, among all other factors, network strength for accessing the internet should not be a problem."	Internet
Respondent 8:	"the location should be convenient for students, employers and the faculty members … good companies do not want to come for a placement drive to a location which is remote and not easy to travel a good location can give a good environment to the students to study in that environment."	Awareness; Connectivity; Commutation; Closeness to employers; Environment
Respondent 9:	"there must be the availability of basic amenities such as transportation, medical facilities quality of life is an important aspect for the location selected Malls, restaurants, water parks, and other amusement facilities should be nearby mismatch with local culture and language is another important issue to be considered."	Transportation; Medical services; Quality of life; Familiarity with local language and culture
Respondent 10:	"Ambience has to be very good Safety issues need to be kept in mind business persons do not like to visit to distant place far from the city"	Environment; Safety; Closeness to employers

Table 3. Criteria for facility location selection.

Identified Factors	Location Selection Criteria	Symbol
Awareness	Location awareness	C_1
Connectivity; Commutation; Transportation	Convenience in travelling	C_2
Travelling time	Commutation time	C_3
Closeness to market; Connectivity	Connectivity with market	C_4
Closeness to employers; Connectivity	Connectivity with the recruiters/industrial zones	C_5
Quality of life; Connectivity	Availability of the amusement facilities	C_6
Medical services; Connectivity	Availability of medical facilities	C_7
Internet	Internet accessibility	C_8
Noise; Environment; Pollution	Environment friendliness	C_9
Safety	Safety	C_{10}
Cost of travel	Cost of commutation/living	C_{11}
Familiarity with local language and culture	Familiarity with the local language	C_{12}

2.2. Methods

The present study uses a combined multi-criteria group decision making framework based on PIPRECIA and LBWA. In addition, for checking group harmony in opinion building, Kendall's concordance coefficient [34] is calculated. In this section, the computational steps for each such method are described.

2.2.1. PIPRECIA

In this study, the PIPRECIA method is used for prioritizing the factors (i.e., criteria) for location selection. It is an extended version of stepwise weight assessment ratio analysis (SWARA) [53]. The basic computational steps for this method are quite similar to that of SWARA, as both the methods call for pairwise comparison based on relative significance of the criteria which are made according to the opinions of the respondents or experts in a group decision making environment. In the case of PIPRECIA, ordering of the criteria at the beginning stands as optional. The algorithm of PIPRECIA [35] is described by using the computational steps as given in the following table (refer Table 4).

2.2.2. LBWA

LBWA is one of the newest additions to the portfolio of the multi-criteria-based group decision making algorithms [36]. It is used to determine relative criteria weights based on subjective information. In comparison with some of the popularly used subjective opinion based group decision making frameworks like the Analytic Hierarchy Process model (AHP) [54], the Decision Making Trial and Evaluation Laboratory (DEMATEL) method [55], and the Best Worst Method (BWM) [56], LBWA provides some advantages to the analysts [36], such as

- Computational advantage: LBWA requires $(n-1)$ number of criteria comparisons, which is substantially less as compared with AHP (number of comparisons = $\frac{n\,(n-1)}{2}$), DEMATEL (number of comparisons = $n(n-1)$), and BWM (number of comparisons = $(2n-3)$). The lower number of comparisons in effect reduces model complexity and computational effort.
- Simplicity of operation: LBWA can be applied in rational decision making in complex situations with a large number of criteria set.
- Reduction in inconsistency with added flexibility: This model allows for reducing the inconsistencies in the subjective opinions given by the decision maker as compared with AHP or BWM. Researchers [57] pointed out that given a set of ten criteria, it is quite impossible to achieve full consistency. Dividing the main criteria into subsequent sub-criteria, consistency can be achieved to a considerable level, but in the process, it adds more complexity. Furthermore,

with the help of the elasticity coefficient, LBWA provides flexibility to the decision makers and induces additional corrections of the values of criteria weights.

Table 4. Pivot pairwise relative criteria importance assessment (PIPRECIA) method.

Computational Steps
Step 1: Selection of the criteria set.
Step 2: Sorting of the criteria based on their expected significances as opined by the decision makers. This step stands as optional in this method since it is formulated to consider a large group of respondents
Step 3: Defining the relative significance of the criteria under consideration. Starting from the second criterion, the relative importance or significance of any criterion C_j is given by: $$S_j^r = \begin{cases} >1 & \text{when } C_j > C_{j-1} \\ 1 & \text{when } C_j = C_{j-1} \\ <1 & \text{when } C_j < C_{j-1} \end{cases}$$ Here, 'r' denotes a particular respondent among all.
Step 4: Determination of the coefficient K_j^r $$K_j^r = \begin{cases} 1 & \text{when } j = 1 \\ 2 - S_j^r & \text{when } j > 1 \end{cases}$$
Step 5: Recalculation of the criteria significance $$Q_j^r = \begin{cases} 1 & \text{when } j = 1 \\ \frac{Q_{j-1}^r}{K_j^r} & \text{when } j > 1 \end{cases}$$
Step 6: Determination of the relative criteria weights $$W_j^r = \frac{Q_j^r}{\sum_{j=1}^n Q_j^r}$$
Step7: Calculation of final criteria weights Finally, for deriving the group weight at consensus, geometric mean (GM) of individual weights is calculated as: $$W_j^* = \left(\prod_{r=1}^R W_j^r\right)^{1/R}$$ where 'R' is the total number of respondents. Accordingly, the final criteria weights are given by: $$W_j = \frac{W_j^*}{\sum_{j=1}^n W_j^*}$$

The steps for computing the criteria weights based on the algorithm of LBWA is given in the following table (refer Table 5).

Table 5. Level-based weight assessment (LBWA) method.

Computational Steps

Step 1: Determination of the most important criteria
Let, C_j (where, j = 1, 2, 3 … ..n) are the criteria involved in the decision making process. Therefore, the criteria set is given by $S = \{C_1, C_2, C_3 \ldots\ldots C_n\}$. Let, the ith criterion ($C_i \in S$) is the most important criterion according to the decision maker.

Step 2: Formation of subsets of criteria by grouping based on level of significance.
The grouping process is demonstrated below.
Level S_1: Group the criteria and form the subset with the criteria having equal to or up to twice as less as the significance of the criterion C_i
Level S_2: Group the criteria and form the subset with the criteria having exactly twice as less as the significance of the criterion C_i or up to three times as less as the significance of the criterion C_i
Level S_3: Group the criteria and form the subset with the criteria having exactly three times as less as the significance of the criterion C_i or up to four times as less as the significance of the criterion C_i
– –
Level S_k: Group the criteria and form the subset with the criteria having exactly 'k' times as less as the significance of the criterion C_i or up to 'k + 1' times as less as the significance of the criterion C_i
Hence,

$$S = S_1 \cup S_2 \cup S_3 \ldots\ldots \cup S_k$$

If $s(C_j)$ is the significance of the jth criterion, it can be stated that.

$$S_k = \left\{C_j \in S : k \le s(C_j) \le k+1\right\}$$

Also, the following condition holds good to appropriately define the grouping

$$S_p \cap S_q = \varnothing;\ \text{where } p, q \in \{1, 2, \ldots k\} \text{ and } p \neq q$$

Step 3: Comparison of criteria according to the significance within the subsets
Based on the comparison, each criterion $C_j \in S_k$ is assigned with an integer value $I_{C_j} \in \{0, 1, 2 \ldots\ldots r\}$; where, r is the maximum value on the scale for comparison and is given by:

$$r = \max\{|S_1|, |S_2|, |S_3| \ldots\ldots |S_k|\}$$

Conditions followed in this context are

(i) The most important criterion is assigned with an integer value of zero. In other words,

$$I_{C_i} = 0$$

(ii) If C_p is more significant than C_q, then

$$I_{C_p} < I_{C_q}$$

(iii) if C_p is equally significant with C_q, then

$$I_{C_p} = I_{C_q}$$

Step 4: Defining the elasticity coefficient
The elasticity coefficient τ is defined as any number belonging the set of real numbers which meets the condition $\tau > r$ and $\tau \in \mathbb{R}$; Where $\mathbb{R}$ represents a set of real numbers

Step 5: Deriving the influence function of the criteria
For a particular criterion $C_j \in S_k$, the influence function can be defined as $f : S \to R$
It is calculated as

$$f(C_j) = \frac{\tau}{k\tau + I_{C_j}}$$

where k is the number of level or subset to which C_j belongs and $I_{C_j} \in \{0, 1, 2 \ldots\ldots r\}$ is the value assigned to the criterion C_j within that level

Step 6: Calculation of the optimum values of the criteria weights
For most significant criterion:

$$w_i = \frac{1}{1 + f(C_1) + f(C_2) + \cdots + f(C_n)}$$

where $i \in j$; $j = 1, 2, \ldots, n$, the number of criteria
For other criteria:

$$w_{j \neq i} = f(C_j) w_i$$

2.2.3. Kendall's Concordance Coefficient

In the EOGDM framework, it is important to ensure harmony among the members [58]. The harmony in group decision making can be tested by deriving the Concordance Coefficient (CC) as proposed by Kendall [34]. In tune with the work of Ivlev et al. [59] and Turskis et al. [37], the steps are summarized in the following table (see Table 6).

Table 6. Calculation of Kendall's concordance coefficient.

Computational Steps
Suppose $j = 1, 2, \ldots, n$ is the number of objects under consideration and $t = 1, 2, \ldots, r$ is the number of decision-makers.
Step 1: Determine the mean rank
$$\overline{O_j} = \frac{\sum_{t=1}^{r} O_j^t}{r}$$
O_j^t is the rank assigned by the t^{th} decision-maker to j^{th} object
Step 2: Find out the significance of each object
Significance of j^{th} object is given by
$$q_j = \frac{\overline{O_j}}{\sum_{j=1}^{n} \overline{O_j}}$$
Step 3: Calculation of Kendall's concordance coefficient (W)
$$W = \frac{12S}{r^2(n^3 - n)}$$
$W \in [0, 1]$
S is the sum of squares of deviation of the rank sums obtained by each object with respect to the mean rank.
$$S = \sum_{j=1}^{n} \left(\sum_{t=1}^{r} O_j^t - \frac{1}{n} \sum_{j=1}^{n} \sum_{t=1}^{r} O_j^t \right)^2$$
The higher value of W (closer to 1) represents stronger harmony in group-decision.
Step 4. Verification of the value of W
According to the suggestions given by the researchers [60,61], the verification of W is done by using Pearson's chi-square test.
Accordingly, at a particular significance level α and degrees of freedom $df = n - 1$, first the χ^2 is calculated as:
$$\chi^2{}_{calc} = r\,(n - 1)W$$
If $\chi^2{}_{calc} > \chi^2{}_{\alpha,table}(n - 1)$, then a compatibility of the expert opinions is supported.

3. Findings and Discussion

The respondents involved in this study belong to two groups: SC and EE. In this section, first we present the responses of the SCs and the relative weights of the criteria as derived thereof. Next, we highlight the findings based on the opinions of the EEs. Finally, the two sets of findings are combined. In effect, the final weight of each criterion is a combination of priority order (revealed through SCs' opinions) and relative significance (expressed in EEs' responses).

The SCs deal with a large number of students and their parents, having varying backgrounds and requirements during their decision-making process. The objective of the analysis at this stage is to identify the priority order-based weights of the criteria. Table 7 represents the priority-based ordering of the criteria influencing location selection. Table 8 shows the results of the test of harmony in the group decision making by the SCs.

It is seen from the Table 8 that W is considerably high and $\chi_{calculated} > \chi_{table}$. Therefore, it is inferred that the responses given by the SCs are significantly harmonious in nature. Proceeding further, we calculate the relative weights of the criteria based on priority orders using the LBWA algorithm.

Table 9 shows the summary of the interim calculations and Table 10 exhibits the criteria weights. Here, $\tau = 4$.

Figure 1 is the pictorial representation of the outcome of sensitivity analysis of the results obtained through LBWA. The sensitivity analysis is performed to reduce subjectivity and bias to achieve rational and reliable results [62]. Here, a small sample of experts (i.e., seven) is involved. Hence, the sensitivity analysis needs to be performed, which enables us to check the stability of the final results subject to variation in the conditions [63,64]. In this case, we vary the value of τ from a threshold level (i.e., 4) to higher levels (e.g., 25) and observe whether there is any change in relative positions [36]. We see that the relative weights of the criteria do not change with the change in the condition. From the responses of the SCs, it is evident that C_2, C_3, and C_1 hold the first three positions, and C_8, C_{12}, and C_6 fall in the lower priority group. This suggests that location and commutation are considered to be more important to aspiring students while they believe that internet availability, language barrier, and amusement are of less importance. However, several B-Schools these days are located on the outskirts of the city. Some of them are operated under residential mode. Hence, location awareness is required, but for residential courses, commutation may not be so important. With the rapid development of information and communication technology, mobile internet speed has increased substantially, and portable routers are also available. Therefore, the internet is not a problem in that sense. Furthermore, many B-Schools in recent years have attempted to design the course to engage the students beyond the classroom, in extra- and co-curricular activities. In addition, cross-cultural teamwork has become an inevitable part of the programs being offered by the B-Schools. Therefore, the positions of these criteria are justified.

Table 7. Summary of responses of student counsellors (SCs) (priority-based ordering).

Criteria	Opinions of the Student Counsellors							Sum of Ranks	Square Deviation
	SC_1	SC_2	SC_3	SC_4	SC_5	SC_6	SC_7		
C_1	4	3	4	2	4	2	1	20	633.361
C_2	1	2	1	1	2	1	7	15	910.028
C_3	3	1	2	3	1	3	8	21	584.028
C_4	5	5	3	5	3	6	6	33	148.028
C_5	2	4	5	4	5	5	5	30	230.028
C_6	12	11	12	12	12	11	9	79	1144.694
C_7	7	7	8	9	7	8	4	50	23.361
C_8	10	10	11	10	11	9	10	71	667.361
C_9	8	8	9	6	6	6	3	46	0.694
C_{10}	6	6	7	7	8	4	2	40	26.694
C_{11}	9	9	6	8	9	7	12	60	220.028
C_{12}	11	12	10	11	10	12	11	77	1013.361

Table 8. Test of harmony in group decision.

Parameter	Value
Mean sum of ranks	45.167
Sum of square deviation (S)	5601.667
Kendall's concordance coefficient (W)	0.7994
$\chi_{calculated}$ at α = 0.05 and df = 11	61.557
χ_{table} value at α = 0.05 and df = 11	19.68

Table 9. LBWA calculations.

Level	Criteria	Positional Significance	Criterion Value (I)
	C_2	0.6212	0
S_1	C_3	0.4202	1
	C_1	0.3871	2
S_2	C_5	0.2430	1
	C_4	0.2197	2
S_3	C_{10}	0.1898	1
	C_9	0.1600	2
S_4	C_7	0.1437	1
S_5	C_{11}	0.1191	1
	C_8	0.0988	1
S_6	C_{12}	0.0911	2
	C_6	0.0890	3

Table 10. Criteria weights (LBWA).

Criteria	Weight	Rank
C_1	0.1391	3
C_2	0.2087	1
C_3	0.1669	2
C_4	0.0835	5
C_5	0.0927	4
C_6	0.0309	12
C_7	0.0491	8
C_8	0.0334	10
C_9	0.0596	7
C_{10}	0.0642	6
C_{11}	0.0397	9
C_{12}	0.0321	11

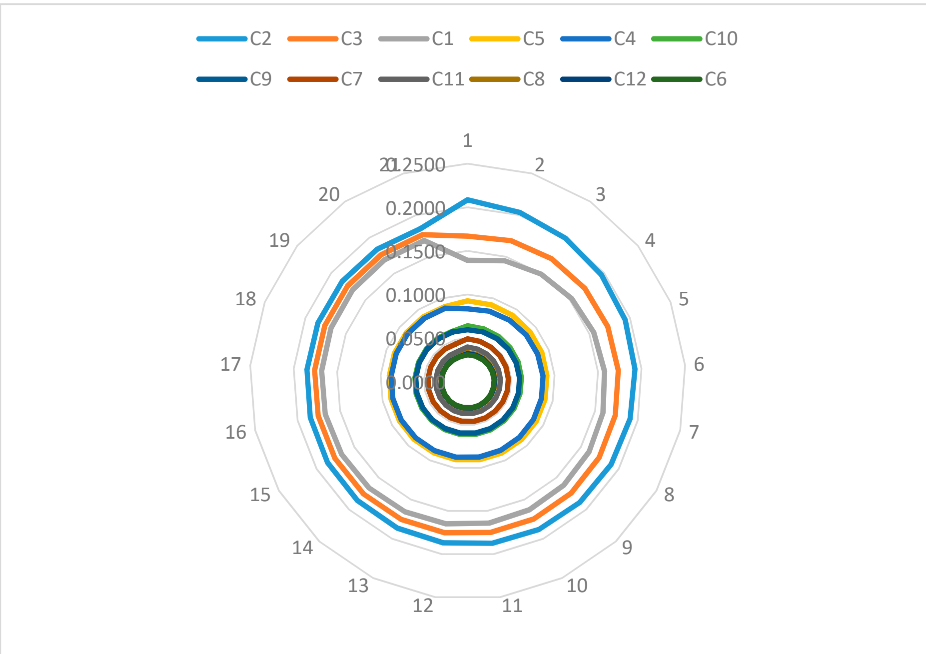

Figure 1. Sensitivity analysis (LBWA).

Moving further, in the next phase, we take opinions of the EEs. The EEs deal with the students and their parents during the admission process and post-admission phase. It is understood that the responses obtained from EEs reveal the relative importance of the criteria vis-à-vis facility location for a B-School. In other words, EEs rate the criteria for location selection based on their experience of interacting with the students. Therefore, in this phase, a recent subjective pairwise comparison-based algorithm, such as PIPRECIA, is used to determine relative criteria weights. Tables 11–13 indicate the responses of the EE panel members individually.

Table 11. Response of the first member of the educators/executives (EE) panel.

Location Criteria	Sj_1	Kj_1	Qj_1	Wj_1
C_1		1.000	1.000	0.0874
C_2	1.45	0.550	1.818	0.1589
C_3	0.7	1.300	1.399	0.1222
C_4	0.6	1.400	0.999	0.0873
C_5	1.25	0.750	1.332	0.1164
C_6	0.2	1.800	0.740	0.0647
C_7	1.15	0.850	0.871	0.0761
C_8	0.55	1.450	0.600	0.0525
C_9	0.9	1.100	0.546	0.0477
C_{10}	1.45	0.550	0.992	0.0867
C_{11}	0.65	1.350	0.735	0.0643
C_{12}	0.2	1.800	0.408	0.0357

Table 12. Response of the second member of the EE panel.

Location Criteria	Sj_2	Kj_2	Qj_2	Wj_2
C_1		1.000	1.000	0.1019
C_2	1.35	0.650	1.538	0.1568
C_3	0.85	1.150	1.338	0.1363
C_4	0.5	1.500	0.892	0.0909
C_5	1.15	0.850	1.049	0.1069
C_6	0.2	1.800	0.583	0.0594
C_7	1.25	0.750	0.777	0.0792
C_8	0.55	1.450	0.536	0.0546
C_9	0.9	1.100	0.487	0.0497
C_{10}	1.35	0.650	0.750	0.0764
C_{11}	0.65	1.350	0.555	0.0566
C_{12}	0.2	1.800	0.309	0.0314

Table 13. Response of the third member of the EE panel.

Location Criteria	Sj_3	Kj_3	Qj_3	Wj_3
C_1		1.000	1.000	0.0870
C_2	1.4	0.600	1.667	0.1451
C_3	0.9	1.100	1.515	0.1319
C_4	0.75	1.250	1.212	0.1055
C_5	1.1	0.900	1.347	0.1172
C_6	0.25	1.750	0.770	0.0670
C_7	1.2	0.800	0.962	0.0837
C_8	0.5	1.500	0.641	0.0558
C_9	0.9	1.100	0.583	0.0507
C_{10}	1.3	0.700	0.833	0.0725
C_{11}	0.65	1.350	0.617	0.0537
C_{12}	0.2	1.800	0.343	0.0298

Table 14 indicates the aggregate ranking of the criteria according to their relative weights, taking the opinions of all members of the EE panel. It is seen that convenience in travelling (C_2); commutation time (C_3) and connectivity with the recruiters/industrial zones (C_5) are perceived as most important criteria, while the criteria including Internet accessibility (C_8); environment friendliness (C_9) and familiarity with the local language (C_{12}) are of lower significance. The responses of EE members and SC panelists are seen as congruent. However, unlike the SCs, the EE members put more emphasis on connectivity with the recruiters as compared with location awareness and assign lesser importance to the environment in comparison with the quality of life. This result is reasonably explanatory, as SCs interact with the students in the decision-making phase, while the EEs review the criteria in the post-admission period. However, it is crucial to examine the consistency in the decisions taken by the EE panel members. The values of the Spearman's rank correlation coefficient (ρ), as given in Table 15, suggest that there is significant coherence in the decision-making. In other words, the results obtained by using the PIPRECIA method are validated.

Table 14. Aggregate rank (EE panel).

Location Criteria	Symbol	Wj *	Wj	Rank_EE
Location awareness	C_1	0.092	0.0920	5
Convenience in Travelling	C_2	0.153	0.1537	1
Commutation Time	C_3	0.130	0.1302	2
Connectivity with market	C_4	0.094	0.0944	4
Connectivity with the recruiters/industrial zones	C_5	0.113	0.1136	3
Availability of the amusement facilities	C_6	0.064	0.0637	8
Availability of medical facilities	C_7	0.080	0.0797	6
Internet accessibility	C_8	0.054	0.0544	10
Environment friendliness	C_9	0.049	0.0494	11
Safety	C_{10}	0.078	0.0784	7
Cost of commutation/living	C_{11}	0.058	0.0581	9
Familiarity with the local language	C_{12}	0.032	0.0323	12

* geometric mean.

Table 15. Consistency test I (Intra-group: EE panel).

EE Member	ρ-Value
EE_1	0.986 **
EE_2	0.993 **
EE_3	0.993 **

** significant at 0.01 level.

However, in order to conclude, there is a need to establish a consensus among the results obtained from two different perspectives. We first check the consistency among the ranking given by the SC and EE panel members. Table 16 shows the values of the correlation coefficients (Kendall's τ and Spearman's ρ). It is seen that the values are considerably high and statistically significant, which implies that the opinions of SCs and EEs are in sync. Furthermore, for aggregating the opinions of the members belonging to two panels, we calculate the geometric means by applying the first equation in Step 7, and the final ranking is obtained by using the second equation in Step 7. Table 17 exhibits the final aggregate ranking of the criteria based on their relative weights. Table 18 shows the results of the consistency check among the rankings of the individual panels and the aggregate ordering. Overall, it is noticed that the final result is consistent with the opinions of the individual panels. However, the opinions of the SC panel members are more reflected in the final result.

Next, we proceed with the validation of the results obtained by using the multi-criteria decision analysis framework. With our limited search, we have not found any similar kind of methodology for prioritizing the criteria for location selection for B-Schools. However, the facility location problem is well known. Several researchers have attempted to solve this problem in different contexts by using multi-criteria-based methods. We check the methodological similarity of our work with the past work on facility location selection. For example, Chakraborty et al. [65] applied five different algorithms (subjective and objective natures) to solve the facility location selection for distribution centers. In vorder to validate the results, first they checked the consistency among the rankings obtained from different methods by using Spearman's ρ and Kendall's τ values. Finally, they applied the REGIME method [66,67] to arrive at the conclusive ranking. In the paper [68], the authors followed a two-stage approach. They applied four multi-criteria decision analysis algorithms in the first stage. Next, they used the score values (for each alternative) obtained in the first stage to arrive at the final ranking in the second stage by using another outranking method. In addition, they checked the consistency. The authors [39] applied two fuzzy multi-criteria decision-making approaches for selecting the best possible facility location for a textile company. They checked the validity for each method and, finally, compared the results obtained from two different approaches. Our work is in tune with these procedures. In our work, we check the consistency in the decision-making process by the group members (Tables 8, 15 and 16). In addition, we check the consistency between the aggregate rankings by individual panels and the final ranking. Furthermore, following the approach of Chakraborty et al. [65], we apply the REGIME method (see Table 19).

Table 16. Consistency test II (inter-groups: SC and EE panels).

Test Parameter		Rank EE
Kendall's τ	Rank SC	0.697 **
Spearman's ρ	Rank SC	0.846 **

** significant at 0.01 level.

Table 17. Aggregate rank (SC and EE panel).

Location Criteria	Symbol	Weight (EE)	Weight (SC)	Final Weight	Rank EE	Rank SC	Final Rank
Location awareness	C_1	0.0920	0.1391	0.1147	5	3	3
Convenience in Travelling	C_2	0.1537	0.2087	0.1816	1	1	1
Commutation Time	C_3	0.1302	0.1669	0.1495	2	2	2
Connectivity with market	C_4	0.0944	0.0835	0.0900	4	5	5
Connectivity with the recruiters/industrial zones	C_5	0.1136	0.0927	0.1041	3	4	4
Availability of the amusement facilities	C_6	0.0637	0.0309	0.0450	8	12	10
Availability of medical facilities	C_7	0.0797	0.0491	0.0635	6	8	7
Internet accessibility	C_8	0.0544	0.0334	0.0432	10	10	11
Environment friendliness	C_9	0.0494	0.0596	0.0551	11	7	8
Safety	C_{10}	0.0784	0.0642	0.0720	7	6	6
Cost of commutation/living	C_{11}	0.0581	0.0397	0.0487	9	9	9
Familiarity with the local language	C_{12}	0.0323	0.0321	0.0326	12	11	12

Table 18. Consistency test III.

Test Parameters		Rank EE	Rank SC
Kendall's τ	Final Rank	0.788 **	0.909 **
Spearman's ρ	Final Rank	0.923 **	0.972 **

** Correlation is significant at the 0.01 level (2-tailed).

By using the REGIME method [65–67], we compare the results obtained from PIPRECIA (applied for EE members) and LBWA (applied for SC members). It is seen from Table 18 that both the rankings are consistent with the final aggregate results. Table 19 shows that there are ties in some places. However, the ranking obtained by using REGIME method has similarity with the combined rating provided by the SC and EE members. Hence, our final result (Table 17) is acceptable.

Table 19. Pairwise comparison results (REGIME method).

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}	C_{12}	# Positive	Rank
C_1	0	−1	−1	0	0	1	1	1	1	1	1	1	9	3
C_2	1	0	1	1	1	1	1	1	1	1	1	1	11	1
C_3	1	−1	0	1	1	1	1	1	1	1	1	1	10	2
C_4	0	−1	−1	0	−1	1	1	1	1	1	1	1	8	5
C_5	0	−1	−1	1	0	1	1	1	1	1	1	1	9	3
C_6	−1	−1	−1	−1	−1	0	−1	0	0	−1	0	0	4	9
C_7	−1	−1	−1	−1	−1	1	0	1	0	0	1	1	6	6
C_8	−1	−1	−1	−1	−1	0	−1	0	0	−1	−1	1	3	11
C_9	−1	−1	−1	−1	−1	0	0	0	0	−1	0	1	5	8
C_{10}	−1	−1	−1	−1	−1	1	0	1	1	0	1	1	6	6
C_{11}	−1	−1	−1	−1	−1	0	−1	1	0	−1	0	1	4	9
C_{12}	−1	−1	−1	−1	−1	0	−1	−1	−1	−1	−1	0	1	12

4. Implications and Future Scope

Most often, the promoters of the B-Schools conduct a feasibility study before setting up a B-School, which gets influenced by factors including the availability of land, cost of establishment, courses to be offered, quality of the faculty members, and global and local connections. Location is given due importance, but the availability of land at an affordable price predominantly influences that decision. Many times, the selected location is not suitable or preferred by the students. However, for reputed and age-old B-Schools, it may be possible to offset the wrong choice of location by using a considerable level of brand awareness among the aspiring students. Nevertheless, the majority of the B-Schools, in many instances, face problems with their facility location selection. The present study reveals the considerations of the students and their parents vis-à-vis the locations of the B-Schools. This study shows that awareness, connectivity, time, and safety are perceived as important dimensions by the stakeholders. This finding is significant for planning purposes. The location selection decision should not only take into account economic and social parameters. The policy makers need to give due importance to trouble-free fast commutation and select a hazard free place for setting up the facilities. In this sense, this study also supports the views expressed in the earlier works [69,70] in related fields. Therefore, this study might be useful for the B-Schools, mainly newly coming up and second-tier institutions.

However, the present study is a small-scale investigation which may be treated as an attempt to provide the policymakers an understanding of the stakeholders' (i.e., potential students and their parents) concern related to the location of the B-Schools. There are some limitations to this work that invoke some future research agenda. Firstly, the findings show the dominance of the commutation and traveling time, which might not be relevant to the residential B-Schools. Hence, future work may stratify the criteria based on the types of the B-Schools (e.g., residential and non-residential) and subsequently shall attempt to find out the critical factors. Following this work, at a later stage, a comparative analysis may be carried out. Secondly, a large-scale empirical study may be taken up to investigate the impact of location on enrolling in the programs offered by the B-School compared with other factors influencing the selection of B-School. In addition, future work may try to determine the comparative impacts of the criteria related to the location decision on the choice of the B-Schools. Thirdly, the other stakeholders like recruiters and employees may also need to be included in a multi-stakeholder centric comprehensive assessment. Fourthly, considering the location as a standalone dimension, a comparative study can be made between some successful and unsuccessful B-Schools in India based on the criteria, as discussed in the present study. Finally, LBWA is a newly introduced methodology; a fuzzy-based or rough extension can be applied for a subjective opinion-based study, as in the current research work.

5. Conclusions

Understanding the requirements of the stakeholders, including potential students and their parents, is of paramount importance for the higher educational institutions. B-Schools are no exception. In this study, we have addressed the location selection problem using a multi-criteria decision analysis framework that applies a combination of PIPRECIA and LBWA algorithms. We observe that location awareness and traveling aspects are given more importance by the respondents who belong to two groups, such as student counselors and educators or executives. We take the opinions of these experts and treat the same as a reflection of the voice of the service takers (i.e., the voice of the aspirants/potential students). The limitations are also mentioned in the penultimate section. However, the framework based on PIPRECIA and LBWA has been used rarely in the literature. Hence, this framework may be explored in deriving multi-criteria-based solutions for real-life problems like the one that has been addressed in the present study.

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