

3.3.Degree of competition	(0.63, 0.88, 1.00)
3.4.Opportunity for new technology/market	(0.48, 0.73, 0.89)
4.1.Competence and experience on similar projects	(0.70, 0.95, 1.00)
4.2.Knowledge/skills availability	(0.66, 0.91, 1.00)
4.3.Facilities availability	(0.66, 0.91, 1.00)
4.4.Research staff availability	(0.66, 0.91, 1.00)
5.1.Collaboration of University and Industry	(0.28, 0.53, 0.78)
5.2.Contribution to national economy	(0.50, 0.75, 1.00)
5.3.Conducting Market Research	(0.51, 0.76, 0.93)
5.4.Contributions to the state of knowledge	(0.75, 1.00, 1.00)
6.1.Investment Cost	(0.55, 0.80, 0.96)
6.2. Outsourced benefits and services cost	(0.14, 0.35, 0.60)
6.3. Contribution of profitability	(0.41, 0.66, 0.78)
6.4. Risk for development cost	(0.50, 0.75, 0.91)

The performance ratings of alternatives are aggregated to criteria level employing Eq. (3). Then the aggregated ratings are normalized to criteria level and the weighted distances from ideal solution and anti-ideal solution are calculated via Eqs. (4) and (5). Finally, the proximity of the alternatives to the ideal solution are computed and the alternatives are ranked according to these values as in Table 7.

TABLE VII. RANKING OF PROJECTS

Project	P_i^*	Ranking
P_1	0.84	1
P_2	0.51	7
P_3	0.81	2
P_4	0.46	8
P_5	0.70	5
P_6	0.78	3
P_7	0.70	4
P_8	0.67	6

TABLE VI. AGGREGATED RATINGS OF ALTERNATIVES

Sub-Criteria	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8
1.1.Innovation of Technology	(0.70, 0.95, 1.00)	(0.20, 0.45, 0.70)	(0.70, 0.95, 1.00)	(0.09, 0.29, 0.54)	(0.50, 0.75, 1.00)	(0.61, 0.86, 1.00)	(0.61, 0.86, 1.00)	(0.54, 0.79, 1.00)
1.2.Advancement of technology	(0.65, 0.90, 0.95)	(0.23, 0.48, 0.73)	(0.65, 0.90, 0.95)	(0.23, 0.48, 0.73)	(0.58, 0.83, 0.95)	(0.49, 0.74, 0.95)	(0.29, 0.54, 0.79)	(0.45, 0.70, 0.95)
1.3.Key of technology	(0.65, 0.90, 0.95)	(0.28, 0.53, 0.78)	(0.56, 0.81, 0.95)	(0.25, 0.50, 0.75)	(0.56, 0.81, 0.95)	(0.65, 0.90, 0.95)	(0.56, 0.81, 0.95)	(0.49, 0.74, 0.95)
1.4.Patentability	(0.60, 0.85, 0.90)	(0.00, 0.05, 0.30)	(0.44, 0.69, 0.90)	(0.00, 0.25, 0.50)	(0.56, 0.81, 0.90)	(0.48, 0.73, 0.90)	(0.60, 0.85, 0.90)	(0.40, 0.65, 0.90)
1.5.Uniqueness of technology/product	(0.60, 0.85, 0.90)	(0.09, 0.30, 0.55)	(0.44, 0.69, 0.90)	(0.00, 0.18, 0.43)	(0.60, 0.85, 0.90)	(0.53, 0.78, 0.90)	(0.19, 0.44, 0.69)	(0.40, 0.65, 0.90)
1.6.Technological extendibility	(0.70, 0.95, 1.00)	(0.40, 0.65, 0.90)	(0.50, 0.75, 1.00)	(0.18, 0.43, 0.68)	(0.58, 0.83, 1.00)	(0.50, 0.75, 1.00)	(0.61, 0.86, 1.00)	(0.50, 0.75, 1.00)
2.1.Safety considerations	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)
2.2.Benefits for human life	(0.75, 1.00, 1.00)	(0.50, 0.75, 1.00)	(0.75, 1.00, 1.00)	(0.34, 0.59, 0.84)	(0.00, 0.25, 0.50)	(0.66, 0.91, 1.00)	(0.23, 0.48, 0.73)	(0.25, 0.50, 0.75)
2.3.Political factors	(0.25, 0.50, 0.75)	(0.25, 0.50, 0.75)	(0.25, 0.50, 0.75)	(0.25, 0.50, 0.75)	(0.25, 0.50, 0.75)	(0.25, 0.50, 0.75)	(0.25, 0.50, 0.75)	(0.25, 0.50, 0.75)
2.4.Job creation opportunity	(0.23, 0.48, 0.73)	(0.08, 0.33, 0.58)	(0.23, 0.48, 0.73)	(0.08, 0.33, 0.58)	(0.23, 0.48, 0.73)	(0.23, 0.48, 0.73)	(0.30, 0.55, 0.73)	(0.23, 0.48, 0.73)
2.5.The satisfaction of the employee	(0.70, 0.95, 1.00)	(0.11, 0.36, 0.61)	(0.54, 0.79, 1.00)	(0.05, 0.30, 0.55)	(0.66, 0.91, 1.00)	(0.75, 1.00, 1.00)	(0.38, 0.63, 0.88)	(0.63, 0.88, 1.00)
3.1.Opportunity/probability for market success	(0.71, 0.96, 1.00)	(0.13, 0.38, 0.63)	(0.58, 0.83, 1.00)	(0.38, 0.63, 0.88)	(0.58, 0.83, 1.00)	(0.46, 0.71, 0.96)	(0.58, 0.83, 1.00)	(0.50, 0.75, 1.00)
3.2.Potential size of market	(0.75, 1.00, 1.00)	(0.21, 0.43, 0.68)	(0.75, 1.00, 1.00)	(0.00, 0.25, 0.50)	(0.66, 0.91, 1.00)	(0.43, 0.68, 0.88)	(0.54, 0.79, 0.91)	(0.50, 0.75, 1.00)
3.3.Degree of competition	(0.75, 1.00, 1.00)	(0.38, 0.59, 0.84)	(0.71, 0.96, 1.00)	(0.36, 0.61, 0.86)	(0.75, 1.00, 1.00)	(0.71, 0.96, 1.00)	(0.66, 0.91, 1.00)	(0.71, 0.96, 1.00)
3.4.Opportunity for new technology/market	(0.75, 1.00, 1.00)	(0.35, 0.60, 0.76)	(0.75, 1.00, 1.00)	(0.13, 0.30, 0.55)	(0.71, 0.96, 1.00)	(0.66, 0.91, 1.00)	(0.75, 1.00, 1.00)	(0.54, 0.79, 1.00)
4.1.Competence and experience on similar projects	(0.75, 1.00, 1.00)	(0.21, 0.46, 0.71)	(0.71, 0.96, 1.00)	(0.00, 0.25, 0.50)	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)	(0.38, 0.63, 0.88)	(0.55, 0.80, 1.00)
4.2.Knowledge/skills availability	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)
4.3.Facilities availability	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)	(0.50, 0.75, 1.00)
4.4.Research staff availability	(0.66, 0.91, 1.00)	(0.25, 0.50, 0.75)	(0.58, 0.83, 1.00)	(0.25, 0.50, 0.75)	(0.66, 0.91, 1.00)	(0.66, 0.91, 1.00)	(0.41, 0.66, 0.91)	(0.59, 0.84, 1.00)
5.1.Collaboration of University and Industry	(0.58, 0.83, 1.00)	(0.00, 0.00, 0.25)	(0.50, 0.75, 1.00)	(0.00, 0.00, 0.25)	(0.54, 0.79, 0.91)	(0.66, 0.91, 1.00)	(0.05, 0.30, 0.55)	(0.50, 0.75, 1.00)
5.2.Contribution to national economy	(0.75, 1.00, 1.00)	(0.30, 0.55, 0.80)	(0.75, 1.00, 1.00)	(0.33, 0.58, 0.83)	(0.75, 1.00, 1.00)	(0.63, 0.88, 1.00)	(0.75, 1.00, 1.00)	(0.66, 0.91, 1.00)
5.3.Conducting Market Research	(0.75, 1.00, 1.00)	(0.41, 0.66, 0.91)	(0.75, 1.00, 1.00)	(0.25, 0.50, 0.75)	(0.75, 1.00, 1.00)	(0.50, 0.75, 1.00)	(0.75, 1.00, 1.00)	(0.58, 0.83, 1.00)
5.4.Contributions to the state of knowledge	(0.75, 1.00, 1.00)	(0.24, 0.49, 0.70)	(0.70, 0.95, 1.00)	(0.16, 0.41, 0.63)	(0.75, 1.00, 1.00)	(0.75, 1.00, 1.00)	(0.45, 0.70, 0.91)	(0.70, 0.95, 1.00)
6.1.Investment Cost	(450, 530, 550)	(420, 450, 500)	(460, 480, 510)	(150, 158, 160)	(1400, 1500, 1700)	(720, 758, 800)	(360, 390, 410)	(1200, 1300, 1500)
6.2. Outsourced benefits and services cost	(20, 25, 30)	(10, 13, 15)	(20, 25, 30)	(5, 8, 10)	(45, 56, 60)	(15, 18, 20)	(10, 12, 15)	(40, 44, 50)
6.3. Contribution of profitability	(0.66, 0.91, 1.00)	(0.28, 0.53, 0.78)	(0.66, 0.91, 1.00)	(0.19, 0.33, 0.58)	(0.66, 0.91, 1.00)	(0.66, 0.91, 1.00)	(0.66, 0.91, 1.00)	(0.50, 0.75, 1.00)
6.4. Risk for development cost	(0.59, 0.84, 1.00)	(0.09, 0.30, 0.55)	(0.54, 0.79, 1.00)	(0.00, 0.16, 0.41)	(0.66, 0.91, 1.00)	(0.55, 0.80, 1.00)	(0.21, 0.46, 0.71)	(0.54, 0.79, 1.00)

According to the results of the analysis, Fuse Assembly Machine project is identified as the most suitable project, which is followed by Glass Shelf Assembly Machine project. Hot-forging Press Machine Automation project and Gear Console Assembly Machine project are not suitable projects for the case company.

IV. CONCLUSION

Identifying the most appropriate project that match up with the organization's goals is getting much more importance under restricted resources. Therefore, R&D project selection is a challenging process for many decision-makers since it includes evaluation of a wide range of factors, including economic, technical strategic etc. It is also a complex procedure with a characteristic of multi steps, a group of decision-maker who have diverse ideas and experiences, multiple and contradictory objectives, imprecision in forecasting future achievement and high risk in projects.

In this study, a hierarchical fuzzy MCDM method is employed to select the most suitable R&D project in a company. Selection criteria are determined by means of literature. A hierarchical structure for criteria including 6 main criteria and 27 sub-criteria were decided. 4 decision-makers and 8 projects took part for selection process. The suggested methodology can be applied for further evaluation of other R&D projects in the company. This technique will lead a scientific way, which corresponds to needs in the R&D center to determine the most appropriate alternative. Future researches might focus on employing an analytical technique to determine the weights of the decision makers.

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