

# Fuzzy DEMATEL and Fuzzy Binary Logistic Regression with Simulated Annealing Optimization for Risk Analysis and Mitigation in Industrial Projects in East Africa

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## Hailu Worku\*

*Department of Architecture, Ethiopian Institute of Architecture, Building Construction and City Development, Addis Ababa University, Addis Ababa, Ethiopia*

**\*Address for Correspondence:** Hailu Worku, Department of Architecture, Ethiopian Institute of Architecture, Building Construction and City Development, Addis Ababa University, Addis Ababa, Ethiopia; E-mail: hailuworku1@yahoo.com

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## Supplementary

Risk factor	Impact score	Probability score
Performance	0.25	0.15
Quality	0.3	0.2
Efficiency	0.35	0.25
Reliability	0.4	0.3
Equipment	0.45	0.35
Demand	0.5	0.4
Price	0.55	0.45
Competition	0.6	0.5
Satisfaction	0.65	0.55
Salling price	0.7	0.6
Revenues	0.75	0.65
Profits	0.8	0.7
Cash flows	0.85	0.75
Investments	0.9	0.8
Laws	0.95	0.85
Regulations	1	0.9
Standards	1.05	0.95
Contracts	1.1	1
Intellectual property rights	1.15	1.05

Environment	1.2	1.1
Health	1.25	1.15
Safety	1.3	1

**Table 1.** Optimal values of impact and probability scores of risk factors.

Risk factor	Prominence degree	Relation degree	Group	Impact score	Probability score	Level
Regulations	0.95	0.9	Cause	1	0.9	High
Standards	0.9	0.85	Cause	1.05	0.95	High
Laws	0.85	0.8	Cause	0.95	0.85	High
Contracts	0.8	0.75	Cause	1.1	1	High
Intellectual property rights	0.75	0.7	Cause	1.15	1.05	High
Environment	0.7	0.65	Cause-effect	1.2	1	High
Health	0.65	0.6	Cause-effect	1.25	1	High
Safety	0.6	0.55	Cause-effect	1.3	1	High
Well-Being stakeholders	0.55	-0.5	Effect	1.35	-0.98	High
Well-Being communities	-0.5	-0.45	-Effect	-1.4	-0.97	High
Employee skills	-0.45	-0.4	-Effect	-1.45	-0.96	High
Employee motivation	-0.4	-0.35	-Effect	-1.5	-1	
Employee performance	-0.35	-0.3	-Effect	-1.55	-0.99	High
Retention	-0.3	-0.25	-Effect	-1.6	-0.92	High
Culture of the employees	-0.25	-0.2	-Effect	-1.65	-0.99	High
Managers of the company	-0.2	-0.15	-Effect	-1.7	-0.97	High
Investments	0.15	0.1	Independent	0.9	0.8	Medium
Cash flows	0.1	0.05	Independent	0.85	0.75	Medium
Profits	0.05	0	Independent	0.8	0.7	Medium

**Table 2.** Ranking and classification of risk factors based on fuzzy DEMATEL method and IP table.

Risk factor	Probability of low risk	Probability of medium risk	Probability of high risk
Regulations	0.1	0.2	0.7
Standards	0.15	0.25	0.6
Laws	0.2	0.3	0.5

Contracts	0.25	0.35	0.4
Intellectual property rights	0.3	0.4	0.3
Environment	0.35	0.45	0.2
Health	0.4	0.5	0.1
Safety	0.45	0.55	0
Well-being Stakeholders	0.5	-0.6	-1
Well-being communities	0.55	-0.65	-1.2
Employee skills	0.6	-0.7	-1.3
Employee motivation	0.65	-0.75	-1.4
Employee performance	0.7	-0.8	-1.5
Retention	0.75	-0.85	-1.6
Culture of the employees	0.8	-0.9	-1.7
Managers of the company	0.85	-0.95	-1.8
Investments	0.9	0.05	0.05
Cash flows	0.95	0	0.05
Profits	1	0	0.62

**Table 3.** Prediction of level of risk for each risk factor based on fuzzy binary logistic regression.