

Table 3: Normalized initial direct-relation

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21	F22
F1	0.0000	0.0523	0.0510	0.0496	0.0510	0.0482	0.0344	0.0468	0.0331	0.0523	0.0317	0.0482	0.0331	0.0317	0.0303	0.0317	0.0331	0.0523	0.0344	0.0358	0.0537	0.0014
F2	0.0482	0.0000	0.0523	0.0510	0.0152	0.0165	0.0344	0.0165	0.0028	0.0358	0.0344	0.0523	0.0152	0.0523	0.0510	0.0537	0.0523	0.0303	0.0179	0.0523	0.0523	0.0000
F3	0.0344	0.0510	0.0000	0.0523	0.0152	0.0510	0.0317	0.0138	0.0331	0.0496	0.0468	0.0510	0.0344	0.0523	0.0523	0.0344	0.0165	0.0496	0.0510	0.0537	0.0523	0.0014
F4	0.0358	0.0372	0.0523	0.0000	0.0152	0.0510	0.0496	0.0358	0.0179	0.0523	0.0482	0.0496	0.0303	0.0496	0.0510	0.0537	0.0358	0.0344	0.0482	0.0523	0.0537	0.0000
F5	0.0372	0.0041	0.0386	0.0331	0.0000	0.0358	0.0372	0.0193	0.0413	0.0399	0.0386	0.0193	0.0138	0.0510	0.0152	0.0179	0.0344	0.0510	0.0358	0.0344	0.0510	0.0000
F6	0.0207	0.0344	0.0523	0.0482	0.0220	0.0000	0.0510	0.0523	0.0468	0.0482	0.0482	0.0496	0.0537	0.0496	0.0482	0.0523	0.0523	0.0207	0.0510	0.0455	0.0482	0.0028
F7	0.0262	0.0386	0.0399	0.0386	0.0207	0.0468	0.0000	0.0482	0.0427	0.0468	0.0537	0.0386	0.0468	0.0455	0.0496	0.0455	0.0523	0.0220	0.0386	0.0372	0.0386	0.0000
F8	0.0207	0.0179	0.0179	0.0358	0.0000	0.0537	0.0537	0.0000	0.0537	0.0496	0.0358	0.0523	0.0468	0.0482	0.0358	0.0358	0.0358	0.0179	0.0000	0.0358	0.0537	0.0000
F9	0.0220	0.0193	0.0179	0.0386	0.0179	0.0523	0.0510	0.0537	0.0000	0.0537	0.0482	0.0358	0.0386	0.0537	0.0179	0.0537	0.0372	0.0179	0.0000	0.0358	0.0358	0.0014
F10	0.0234	0.0372	0.0358	0.0537	0.0358	0.0510	0.0523	0.0358	0.0358	0.0000	0.0537	0.0358	0.0358	0.0523	0.0179	0.0386	0.0358	0.0179	0.0358	0.0358	0.0537	0.0000
F11	0.0372	0.0496	0.0523	0.0537	0.0358	0.0537	0.0482	0.0537	0.0537	0.0468	0.0000	0.0537	0.0372	0.0358	0.0179	0.0537	0.0537	0.0179	0.0358	0.0537	0.0537	0.0179
F12	0.0523	0.0523	0.0537	0.0523	0.0372	0.0482	0.0496	0.0372	0.0523	0.0468	0.0496	0.0000	0.0344	0.0523	0.0510	0.0523	0.0510	0.0537	0.0358	0.0537	0.0537	0.0014
F13	0.0165	0.0248	0.0220	0.0372	0.0220	0.0468	0.0372	0.0386	0.0510	0.0496	0.0482	0.0468	0.0000	0.0523	0.0358	0.0372	0.0523	0.0179	0.0179	0.0358	0.0358	0.0000
F14	0.0510	0.0537	0.0523	0.0510	0.0537	0.0482	0.0468	0.0358	0.0482	0.0441	0.0510	0.0523	0.0482	0.0000	0.0358	0.0523	0.0468	0.0344	0.0358	0.0523	0.0523	0.0014
F15	0.0386	0.0510	0.0523	0.0510	0.0248	0.0482	0.0523	0.0372	0.0523	0.0510	0.0496	0.0482	0.0386	0.0344	0.0000	0.0523	0.0372	0.0207	0.0344	0.0523	0.0344	0.0179
F16	0.0193	0.0510	0.0537	0.0537	0.0179	0.0537	0.0358	0.0537	0.0537	0.0179	0.0537	0.0537	0.0358	0.0358	0.0537	0.0000	0.0358	0.0537	0.0537	0.0537	0.0358	0.0358
F17	0.0372	0.0358	0.0179	0.0358	0.0179	0.0537	0.0537	0.0358	0.0179	0.0537	0.0537	0.0537	0.0537	0.0537	0.0358	0.0358	0.0000	0.0358	0.0358	0.0358	0.0537	0.0179
F18	0.0523	0.0207	0.0358	0.0537	0.0537	0.0537	0.0179	0.0179	0.0179	0.0358	0.0358	0.0358	0.0179	0.0537	0.0179	0.0537	0.0358	0.0000	0.0358	0.0537	0.0537	0.0014
F19	0.0510	0.0344	0.0523	0.0510	0.0358	0.0537	0.0207	0.0234	0.0193	0.0372	0.0386	0.0523	0.0372	0.0537	0.0358	0.0358	0.0358	0.0537	0.0000	0.0537	0.0537	0.0000
F20	0.0523	0.0510	0.0537	0.0537	0.0358	0.0537	0.0358	0.0179	0.0358	0.0537	0.0537	0.0537	0.0358	0.0523	0.0510	0.0468	0.0386	0.0179	0.0537	0.0000	0.0358	0.0358
F21	0.0496	0.0523	0.0510	0.0523	0.0331	0.0344	0.0399	0.0372	0.0358	0.0386	0.0372	0.0386	0.0358	0.0523	0.0331	0.0344	0.0358	0.0358	0.0537	0.0537	0.0000	0.0179
F22	0.0028	0.0207	0.0537	0.0523	0.0179	0.0207	0.0000	0.0000	0.0014	0.0000	0.0179	0.0386	0.0041	0.0372	0.0372	0.0344	0.0028	0.0000	0.0537	0.0358	0.0358	0.0000

Table 4: The total relation

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21	F22	D
F1	0.171	0.234	0.253	0.270	0.182	0.267	0.229	0.212	0.206	0.259	0.244	0.262	0.203	0.255	0.206	0.236	0.221	0.203	0.205	0.250	0.274	0.038	4.880
F2	0.203	0.172	0.238	0.253	0.137	0.219	0.212	0.169	0.163	0.226	0.228	0.249	0.172	0.253	0.212	0.239	0.222	0.170	0.177	0.248	0.253	0.036	4.451
F3	0.207	0.238	0.208	0.276	0.151	0.272	0.228	0.183	0.208	0.259	0.261	0.268	0.206	0.276	0.229	0.243	0.208	0.202	0.223	0.270	0.274	0.040	4.931
F4	0.213	0.231	0.264	0.233	0.154	0.280	0.251	0.210	0.201	0.268	0.269	0.274	0.209	0.280	0.235	0.266	0.232	0.193	0.227	0.276	0.283	0.040	5.091
F5	0.171	0.151	0.198	0.208	0.107	0.210	0.190	0.152	0.178	0.204	0.206	0.190	0.150	0.226	0.154	0.180	0.182	0.170	0.171	0.204	0.225	0.030	3.855
F6	0.204	0.235	0.270	0.287	0.164	0.241	0.261	0.233	0.235	0.273	0.278	0.283	0.238	0.290	0.239	0.273	0.255	0.185	0.234	0.277	0.286	0.044	5.285
F7	0.193	0.221	0.239	0.257	0.151	0.264	0.195	0.213	0.215	0.252	0.263	0.252	0.216	0.264	0.223	0.247	0.238	0.171	0.206	0.249	0.257	0.038	4.824
F8	0.165	0.178	0.192	0.226	0.115	0.242	0.222	0.147	0.204	0.228	0.219	0.236	0.194	0.238	0.187	0.213	0.199	0.147	0.148	0.219	0.241	0.033	4.194
F9	0.166	0.178	0.192	0.228	0.131	0.240	0.218	0.198	0.152	0.231	0.230	0.221	0.186	0.242	0.170	0.228	0.199	0.147	0.148	0.219	0.225	0.034	4.181
F10	0.183	0.210	0.227	0.260	0.159	0.257	0.235	0.193	0.200	0.197	0.252	0.239	0.197	0.260	0.185	0.231	0.213	0.161	0.196	0.237	0.260	0.036	4.586
F11	0.221	0.250	0.273	0.294	0.178	0.293	0.260	0.235	0.242	0.273	0.233	0.288	0.224	0.279	0.213	0.276	0.258	0.184	0.222	0.286	0.294	0.059	5.336
F12	0.249	0.266	0.289	0.310	0.191	0.304	0.275	0.232	0.253	0.289	0.296	0.253	0.233	0.310	0.255	0.290	0.269	0.229	0.235	0.303	0.310	0.046	5.687
F13	0.166	0.189	0.201	0.232	0.139	0.241	0.211	0.188	0.205	0.233	0.236	0.237	0.153	0.248	0.191	0.219	0.218	0.151	0.169	0.225	0.231	0.034	4.318
F14	0.242	0.262	0.281	0.301	0.202	0.297	0.267	0.225	0.245	0.280	0.291	0.296	0.240	0.254	0.236	0.283	0.260	0.207	0.229	0.294	0.302	0.044	5.539
F15	0.215	0.245	0.265	0.283	0.163	0.279	0.256	0.213	0.234	0.269	0.272	0.275	0.218	0.269	0.188	0.267	0.235	0.180	0.214	0.277	0.267	0.057	5.143
F16	0.204	0.250	0.273	0.293	0.161	0.291	0.246	0.232	0.240	0.244	0.282	0.287	0.220	0.277	0.245	0.225	0.239	0.215	0.237	0.286	0.275	0.076	5.300
F17	0.205	0.220	0.222	0.257	0.151	0.272	0.246	0.203	0.193	0.259	0.264	0.267	0.223	0.274	0.211	0.240	0.189	0.185	0.206	0.249	0.272	0.055	4.864
F18	0.208	0.192	0.224	0.257	0.176	0.256	0.198	0.173	0.179	0.227	0.231	0.234	0.176	0.257	0.181	0.240	0.208	0.143	0.195	0.250	0.257	0.037	4.501
F19	0.222	0.222	0.257	0.274	0.170	0.275	0.217	0.192	0.196	0.247	0.252	0.269	0.209	0.277	0.214	0.243	0.225	0.207	0.175	0.270	0.276	0.038	4.927
F20	0.236	0.253	0.277	0.297	0.181	0.294	0.249	0.202	0.226	0.280	0.285	0.290	0.222	0.295	0.244	0.271	0.244	0.186	0.241	0.237	0.279	0.076	5.366
F21	0.222	0.240	0.258	0.278	0.168	0.259	0.237	0.206	0.212	0.251	0.253	0.259	0.209	0.278	0.213	0.243	0.227	0.191	0.227	0.271	0.227	0.056	4.984
F22	0.104	0.131	0.174	0.181	0.095	0.149	0.113	0.096	0.103	0.122	0.142	0.165	0.104	0.166	0.142	0.154	0.112	0.092	0.155	0.162	0.164	0.023	2.849
R	4.369	4.767	5.277	5.756	3.425	5.705	5.016	4.308	4.491	5.373	5.488	5.595	4.402	5.769	4.570	5.309	4.854	3.918	4.438	5.560	5.731	0.969	105.091

The total effects given and received by each indicator were also calculated according to Equation (3.7) and Equation (3.8). The determinants of the sum of the row (D) and the sum of column (R) were added together to obtain the centrality (D + R). The higher the centrality (D + R), the higher was the importance of the indicator. The determinants of the sum of the row were subtracted from the sum of column to obtain the degree of cause and effect (D – R). The higher the positive degree of cause and effect (D – R), the easier item directly influencing the other indicators, whereas the higher the negative degree of cause and effect, the easier was the indicator to be influenced by other indicators. Table 4 summarized the total effects given and received by each indicator.

The threshold value (α) was computed by the average of the elements in the total relation matrix T in order to eliminate some minor effects elements. It was calculated according to Equation (3.9) and revealed that the threshold value (α) was 0.217, i.e. 105.091 divided by 484. The boldfaced elements in the total relation matrix T, shown in Table 3, represent values greater than the threshold value (α).

Table 5: Total Effect of the Overall Influence

Performance Indicators	Rate of the effect on another indicator D	Rate of the effect from another indicator R	D+R	D-R
Leadership Proficiency	4.880	4.369	9.249	0.511
Strategy Formulation	4.451	4.767	9.218	-0.316
Vision Development	4.931	5.277	10.208	-0.346
Future Excellence	5.091	5.756	10.847	-0.664
Organizational Structure	3.855	3.425	7.280	0.430
Customer Orientation	5.285	5.705	10.990	-0.420
Mass Production	4.824	5.016	9.840	-0.192
Strategic Partner Relationship	4.194	4.308	8.502	-0.114
Resources Utilization	4.181	4.491	8.673	-0.310
Process Orientation	4.586	5.373	9.959	-0.787
Quality Assess	5.336	5.488	10.824	-0.153
Competitive Aggressiveness	5.687	5.595	11.281	0.092
Delivery Assess	4.318	4.402	8.719	-0.084
Efficiency Level	5.539	5.769	11.308	-0.230
Sales and Marketing Orientation	5.143	4.570	9.713	0.573
Financial Management	5.300	5.309	10.609	-0.010
Time Utilization	4.864	4.854	9.718	0.011
Human Resource Competencies	4.501	3.918	8.419	0.582
Educational and Training	4.927	4.438	9.365	0.489
Significant Improvement	5.366	5.560	10.926	-0.194
Operation Excellence	4.984	5.731	10.715	-0.747
Government Program Support	2.849	0.969	3.818	1.879

5. Discussion

The importance of the evaluation indicator was determined by $(D + R)$ values. Greater centrality $(D + R)$ value represents that the performance indicator is relatively important. Based on Table 4.15, it is obviously shown that ten indicators were above the average in overall centrality. In the descending order, the most important indicators were 'Efficiency Level', 'Competitive Aggressiveness', 'Customer Orientation', 'Significant Improvement', 'Future Excellence', 'Quality Access', 'Operation Excellence', 'Financial Management', 'Vision Development', 'Process Orientation', and 'Mass Production' which representing the $(D + R)$ values of 11.308, 11.282, 10.989, 10.926, 10.847, 10.824, 10.715, 10.609, 10.208, 9.959, respectively.

The symbol of causality value $D - R$ represents whether the performance indicator affects or is affected by others. Based on values of $D - R$, the indicators have been classified in two groups namely the cause group and effect group. If the value of $D - R$ was positive or net cause, the indicators involved were classified in the cause group, and directly to affect other indicators. In addition, the indicators which have the highest value of $D - R$ had the greatest direct impact on the others. On the other hand, if the value of $D - R$ was negative or net receive, the indicators involved were classified in the effect group, and largely influenced by the others.

From column $(D - R)$ in Table 4, it was found that eight indicators, namely 'Leadership Proficiency', 'Organizational Structure', 'Competitive Aggressiveness', 'Marketing Competencies', 'Time Utilization', 'Human Resource Competencies', 'Educational and Training', and 'Government program support' which have positive $(D - R)$ values of 0.511, 0.430, 0.092, 0.573, 0.011, 0.582, 0.489, and 1.879 respectively, were classified in the cause group. The other fourteen indicators, namely 'Strategy Formulation', 'Vision Development', 'Future Excellence', 'Customer Orientation', 'Mass Production', 'Strategic Partner Relationship', 'Resources Utilization', 'Process Orientation', 'Quality Assess', 'Delivery Assess', 'Efficiency Level', 'Financial Management', 'Significant Improvement', and 'Operation Excellence' which have negative $(D - R)$ values of -0.316, -0.346, -0.664, -0.420, -0.192, -0.114, -0.310, -0.787, -0.153, -0.084, -0.230, -0.010, -0.194, -0.747 respectively, were classified in the effect group.

In summarizing the aforementioned analyses, the importance of the evaluation indicator was determined by $(D + R)$ and $(D - R)$ values. According to the prominence $(D + R)$ and relation $(D - R)$, the twenty-two indicators can be group under four categories to understand the degrees and directions of the interactive influence (Cooper & Schindler, 2006) as follows:

Indicators with high relation and high prominence representing by positive $(D - R)$ value, and higher $(D + R)$ value. This category comprised Leadership Proficiency, Marketing Competencies, Competitive Aggressiveness, Time Utilization, and Educational and Training.

Indicator with high relation and low prominence representing by negative $(D - R)$ value, higher $(D + R)$ value. This category consisted Efficiency Level, Customer Orientation, Significant Improvement, Future Excellent, Quality, Operation Excellence, Financial Management, Vision Development, Process Orientation, Mass Production, and Strategy Formulation.

Indicator with low relation and high prominence representing by positive $(D - R)$ value, and lower $(D + R)$ value. This category included Human Resource Competencies, Organizational structure, and Government program support.

Indicator with low relation and low prominence representing by negative $(D - R)$ value, and lower $(D + R)$ value. This category consisted Strategic Partner Relationship, Resources Utilization, and Delivery Assess.

To be clearer, based on the coordinate position of $(D + R)$ and $(D - R)$, the indicators can be divided into four quadrants as shown in the following Figure 1.

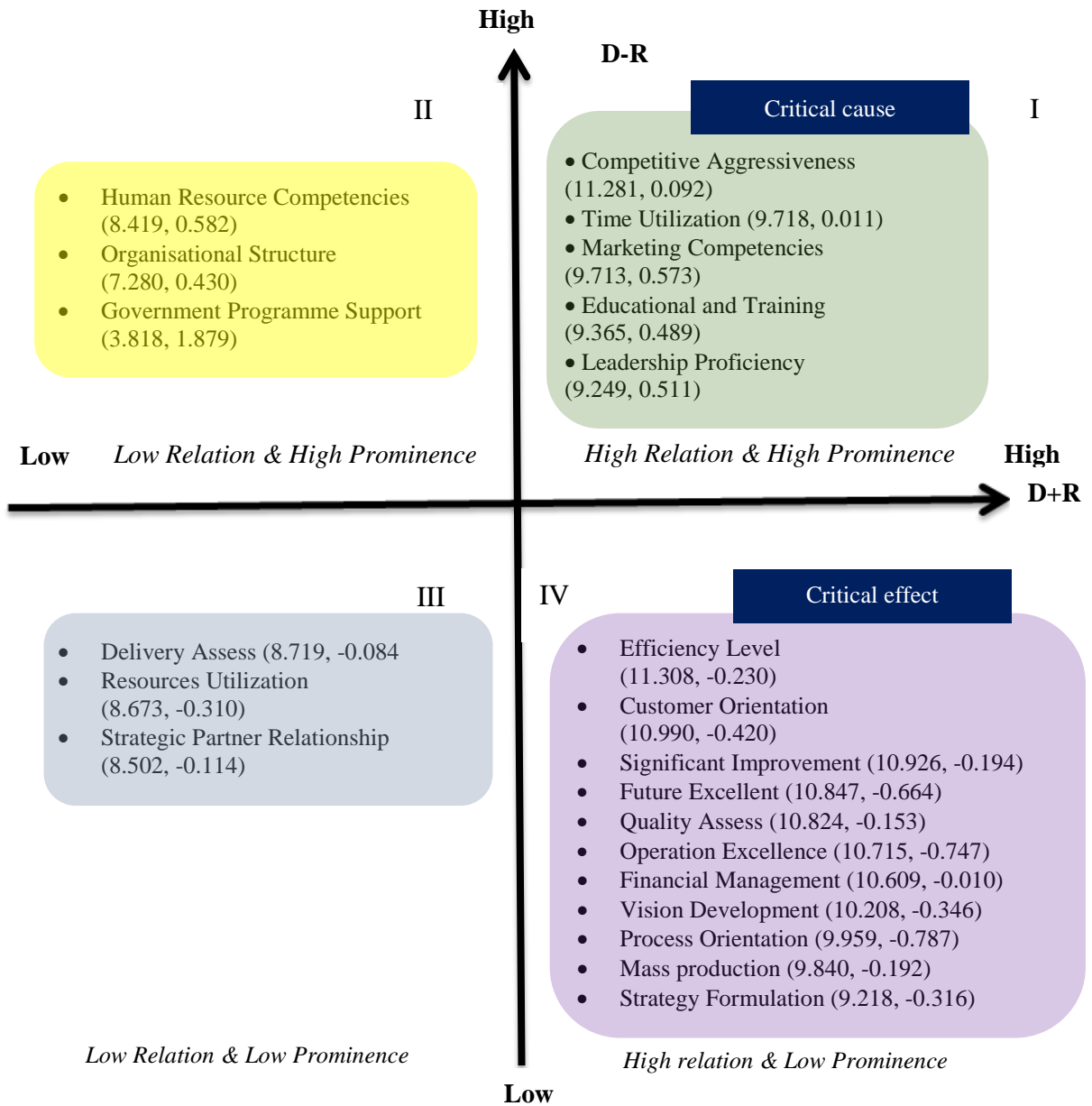


Figure 1. Categorization of the indicators

6. Conclusion

This study discusses the strategy for the development of critical performance indicator in SMEs through DEMATEL. At present, SMEs in Malaysia has very high contribution toward Malaysian economy, however, they are facing high failure rate. It can be seen from the literature that SMEs needs well-developed performance measurement system as a tool to evaluate the performance for effective development and avoid failure in the future. Consequently, from the study results, experts suggest that SMEs in Malaysia should actively focus on five performance indicators which are Leadership Proficiency, Marketing Competencies, Competitive Aggressiveness, Time Utilization, and Educational and Training because they were in cause group, the critical and core indicators influencing other indicators. They are the driving indicators of the problem solving. Any actions taken on these indicators will have wide-ranging impact on other indicators. On the other hand, from the effect group, Efficiency Level, Customer

Orientation, Significant Improvement, Future Excellent, Quality, Operation Excellence, Financial Management, Vision Development, Process Orientation, Mass Production, and Strategy Formulation were the core problems that must be solved. They are highly affected by the other indicators and require more attention. The results suggest that the SMEs should also give more attention to improve these indicators because they are highly affected by other indicators. Research on performance measurement in SMEs in Malaysia is still inadequate, and this study is still in preliminary stage. More detailed discussion and further research on sub-indicators may be able to complete overall study. This will lead to a continuous development towards SMEs industry in Malaysia. Although this study only explores performance indicators in SMEs from Malaysian's background, the results of the study still contribute to the update of literature in the performance measurement, making it a great reference value to decision makers from other countries that interested in developing performance measurement system.

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Biographies

Nor Mahirah Mustapha is Ph.D of Management, Universiti Malaysia Pahang. She Masters in Business Administration (Executive) from Universiti Malaysia Pahang. She has published journal and conference papers.

Shahryar Sorooshian is PhD of industrial engineering and he is currently with School of Business Economics and Law, University of Gothenburg. He published many journals, books and conference papers. He is an accredited management consultant.

Noor Azlinna Azizan is PhD of finance and currently a Professor of finance and entrepreneurship at College of Business Administration, Prince Sultan University in Saudi Arabia. She has published many journals, books and conference papers.