

RESEARCH ARTICLE

# Instilling eco-friendly practices within the maritime industry: An intuitionistic fuzzy decision-analytic model for terminal operating system selection in green ports

## Supplementary Files

**Table S1.** The significance levels of the six experts

Experts	Experience	IF sets	
		$\beta_{Y_g}(z)$	$\gamma_{Y_g}(z)$
E <sub>1</sub>	EE	0.90	0.05
E <sub>2</sub>	O	1.00	0.00
E <sub>3</sub>	M	0.60	0.30
E <sub>4</sub>	O	1.00	0.00
E <sub>5</sub>	ME	0.70	0.20
E <sub>6</sub>	ME	0.70	0.20

Abbreviations: EE: Exceeds expectations; IF: Intuitionistic fuzzy;  
 M: Medium; ME: Meet expectations; O: Outstanding.

**Table S2.** The significance levels of the six experts

Expert	TOS	A1	A2	A2	A4	A5	A6	A7	A8	A9	A10
E1	T1	M	M	M	M	M	M	M	M	M	M
	T2	I	I	I	I	I	I	I	I	I	I
	T3	VI	VI	VI	VI	VI	VI	VI	VI	VI	VI
	T4	M	M	M	M	I	M	I	M	M	I
	T5	VI	I	M	M	I	M	M	M	I	M
E2	T1	M	I	I	M	VI	I	I	UI	M	VI
	T2	I	M	I	I	M	I	VI	UI	VI	I
	T3	VI	I	VI	VI	I	I	VI	M	VI	I
	T4	M	M	M	I	I	M	I	VI	I	I
	T5	VI	I	I	I	VI	I	M	I	I	I
E3	T1	UI	UI	M	UI	M	I	UI	UI	UI	I
	T2	I	M	M	UI	M	UI	I	UI	VI	UI
	T3	I	M	I	I	I	I	I	M	VI	UI
	T4	UI	UI	UI	M	M	UI	UI	M	UI	M
	T5	M	UI	M	UI	I	M	M	UI	M	UI
E4	T1	M	I	I	M	I	I	I	M	UI	VI
	T2	I	I	I	I	I	I	VI	M	VI	I
	T3	VI	VI	VI	VI	I	I	VI	I	I	I
	T4	M	M	M	I	M	M	M	M	M	M
	T5	I	I	I	I	I	M	I	M	M	M
E5	T1	M	M	M	I	VI	I	I	UI	I	I
	T2	I	I	I	VI	I	VI	UI	M	M	M
	T3	M	M	M	VI	I	I	VI	M	M	M
	T4	M	M	M	M	I	M	VI	M	I	I
	T5	M	I	M	M	VI	M	I	M	I	I
E6	T1	I	I	M	I	M	I	UI	M	VI	I
	T2	I	I	I	VI	I	VI	UI	UI	UI	UI
	T3	VI	VI	VI	I	I	VI	M	I	I	I
	T4	M	M	M	M	I	M	UI	M	M	M
	T5	M	I	M	M	VI	M	I	M	M	M

Abbreviations: I: Important; M: Medium; TOS: Terminal operating system; UI: Unimportant; VI: Very important.

**Table S3.** The evaluation of the TOS alternatives by experts (IF sets)<sup>a</sup>

TOS	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>																				
T1	0.7538	0.1463	0.0999	0.5924	0.2504	0.1500	0.6181	0.2285	0.1534	0.6005	0.2395	0.1600	0.7004	0.1690	0.1305	0.6654	0.2052	0.1294	0.6524	0.2050	0.1426	0.5950	0.2569	0.1481	0.6021	0.2500	0.1479		
T2	0.5500	0.3060	0.2292	0.5258	0.2920	0.1822	0.5048	0.3060	0.1892	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170
T3	0.7435	0.1500	0.1065	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470
T4	0.4735	0.3061	0.2204	0.4720	0.3074	0.2206	0.5048	0.3060	0.1892	0.4392	0.3255	0.2353	0.4168	0.3552	0.2280	0.4168	0.3552	0.2280	0.4168	0.3552	0.2280	0.4168	0.3552	0.2280	0.4168	0.3552	0.2280	0.4168	0.3552
T5	0.5452	0.3001	0.2064	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060

Abbreviation: TOS: Terminal operating system.enfitaular

**Table S4.** Results of the aggregated decision matrix ( $\mathbf{B} = [B_{ij}]_{5 \times 10}$ )

TOS	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>																				
T1	0.7538	0.1463	0.0999	0.5924	0.2504	0.1500	0.6181	0.2285	0.1534	0.6005	0.2395	0.1600	0.7004	0.1690	0.1305	0.6654	0.2052	0.1294	0.6524	0.2050	0.1426	0.5950	0.2569	0.1481	0.6021	0.2500	0.1479		
T2	0.5500	0.3060	0.2292	0.5258	0.2920	0.1822	0.5048	0.3060	0.1892	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170	0.2078	0.4752	0.3170
T3	0.7435	0.1500	0.1065	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470	0.1323	0.7207	0.1470
T4	0.4735	0.3061	0.2204	0.4720	0.3074	0.2206	0.5048	0.3060	0.1892	0.4392	0.3255	0.2353	0.4168	0.3552	0.2280	0.4168	0.3552	0.2280	0.4168	0.3552	0.2280	0.4168	0.3552	0.2280	0.4168	0.3552	0.2280	0.4168	0.3552
T5	0.5452	0.3001	0.2064	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060	0.1892	0.5048	0.3060

Abbreviation: TOS: Terminal operating system.enfitaular

**Table S5.** Results of the crisp decision matrix ( $C = [C_{er}]_{5 \times 10}$ )

TOS	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>	A <sub>10</sub>
T1	0.1203	-0.5442	0.3040	0.2898	-0.4893	0.3594	0.6201	-0.6511	0.2032	0.4118
T2	0.5500	-0.6432	0.2062	0.5048	-0.6969	0.1582	0.4752	-0.7196	0.1347	0.7427
T3	0.7202	-0.6863	0.1795	0.7202	-0.8193	0.0552	0.6125	-0.7242	0.1312	0.7782
T4	0.1394	-0.3332	0.3564	0.1394	-0.4392	0.2345	0.4168	-0.3552	0.3281	0.4642
T5	0.5452	-0.6339	0.2181	0.2898	-0.5092	0.3392	0.6519	-0.5403	0.3138	0.2407

Abbreviation: TOS: Terminal operating system.tabular

**Table S6.** Results of the normalized decision matrix ( $D = [D_{er}]_{5 \times 10}$ )

TOS	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>	A <sub>10</sub>
T1	0.1670	1.6334	0.8529	0.4023	1.1140	1.0000	0.9512	1.8332	0.6193	0.5292
T2	0.7636	1.9305	0.5785	0.7009	1.5867	0.4402	0.7290	2.0262	0.4106	0.9544
T3	1.0000	2.0599	0.5036	1.0000	1.8656	0.1536	0.9395	2.0390	0.3999	1.0000
T4	0.1935	1.0000	1.0000	0.1935	1.0000	0.6527	0.6393	1.0000	1.0000	0.5965
T5	0.7569	1.9028	0.6118	0.4023	1.1594	0.9440	1.0000	1.5212	0.9562	0.3093

Abbreviation: TOS: Terminal operating system.

**Table S7.** Results of the decomposition value matrix ( $F = [F_e]_{5 \times 10}$ )

TOS	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>	A <sub>10</sub>
T1	0.8330	0.6334	0.3493	0.5977	0.7516	0.8464	0.3120	0.8332	0.3807	0.4708
T2	0.5966	0.9305	0.4215	0.5074	0.5867	0.5598	0.2710	1.0262	0.5894	0.6451
T3	0.8330	1.0599	0.4964	0.8065	0.8656	0.8464	0.3002	1.0390	0.6001	0.6907
T4	0.8065	1.0599	0.4964	0.8065	0.8656	0.4991	0.3607	1.0390	0.6001	0.4035
T5	0.5899	0.9028	0.3882	0.5977	0.7062	0.7904	0.3607	0.5212	0.5563	0.6907

Abbreviation: TOS: Terminal operating system.

**Table S8.** Results of the logarithmic decomposition value matrix ( $G = [G_f]_{10}$ )

Matrix	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>	A <sub>10</sub>
$G_f$	0.5492	0.6509	0.3579	0.5087	0.5626	0.5356	0.2783	0.6375	0.4353	0.4575

**Table S9.** Results of the standardized decision matrix ( $K = [K_{ef}]_{5 \times 10}$ )

TOS	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>	A <sub>10</sub>
T1	0.1670	1.6334	0.8529	0.4023	1.1140	1.0000	0.9512	1.8332	0.6193	0.5292
T2	0.7636	1.9305	0.5785	0.7009	1.5867	0.4402	0.7920	2.0262	0.4106	0.9544
T3	1.0000	2.0599	0.5036	1.0000	1.8656	0.1536	0.9395	2.0390	0.3999	1.0000
T4	0.1935	1.0000	1.0000	0.1935	1.0000	0.6527	0.6393	1.0000	1.0000	0.5965
T5	0.7569	1.9028	0.6118	0.4023	1.1594	0.9440	1.0000	1.5212	0.9562	0.3093

**Table S10.** Results of the first weighted decision matrix ( $I = [I_e]_5$ )

Matrix	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>
$L_e$	0.9776	1.1226	1.2107	0.7414	1.0281

**Table S11.** Results of the second weighted decision matrix ( $M = [M_e]_5$ )

Matrix	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>
$M_e$	0.7777	0.9371	0.9246	0.6264	0.8846

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