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Appendix A

Table A-1: Direct influence matrix and Normalized direct influence matrix of barriers

Initial Direct Influence Matrix							
Barriers	Policy (B1)	Financial (B2)	Infrastructure & HR (B3)	Planning & Coordination (B4)	Knowledge (B5)	Uncertainty (B6)	Characteristics of donated food (B7)
Policy (B1)	0	3.75	3	2.75	2.25	2.5	2.25
Financial (B2)	2.5	0	2.75	2.75	2.25	2	2.437
Infrastructure & HR (B3)	2.25	2	0	2	2.25	2.25	2.25
Planning & Coordination (B4)	2.5	3	3.25	0	3	2.75	2.5
Knowledge (B5)	2.25	2.5	1.5	2	0	3	2
Uncertainty (B6)	2	2	2.75	3	2.25	0	2.25
Characteristics of donated food (B7)	2.25	2.5	2.25	2.75	1.25	1.5	0
Normalized Direct Influence matrix							
Barriers	Policy (B1)	Financial (B2)	Infrastructure & HR (B3)	Planning & Coordination (B4)	Knowledge (B5)	Uncertainty (B6)	Characteristics of donated food (B7)
Policy (B1)	0	0.220	0.176	0.161	0.132	0.147	0.132
Financial (B2)	0.147	0	0.161	0.161	0.132	0.117	0.143
Infrastructure & HR (B3)	0.132	0.117	0	0.117	0.132	0.132	0.132
Planning & Coordination (B4)	0.147	0.176	0.191	0	0.176	0.161	0.147
Knowledge (B5)	0.132	0.147	0.088	0.117	0	0.176	0.117
Uncertainty (B6)	0.117	0.117	0.161	0.176	0.132	0	0.132
Characteristics of donated food (B7)	0.132	0.147	0.132	0.161	0.073	0.088	0

Table A-2: Total relation matrix of barriers

Barriers	Policy (B1)	Financial (B2)	Infrastructure & HR (B3)	Planning & Coordination (B4)	Knowledge (B5)	Uncertainty (B6)	Characteristics of donated food (B7)
Policy (B1)	0.767	1.042	1.005	0.976	0.861	0.903	0.881
Financial (B2)	0.820	0.776	0.910	0.893	0.788	0.805	0.814
Infrastructure & HR (B3)	0.735	0.799	0.688	0.780	0.716	0.743	0.732
Planning & Coordination (B4)	0.909	1.025	1.031	0.852	0.909	0.930	0.906
Knowledge (B5)	0.748	0.837	0.787	0.797	0.613	0.791	0.735
Uncertainty (B6)	0.778	0.859	0.890	0.884	0.771	0.682	0.787
Characteristics of donated food (B7)	0.722	0.808	0.793	0.800	0.658	0.693	0.603

Table A-3: Total relation matrix of sub-barriers

Sub-barriers	Low penetration of policies & regulations for donation (A)	Limited funds /commodities raised from the donation (B)	Limited financial support from the government (C)	Lack of storage (D)	Lack of transportation facilities (E)	Lack of collection and distribution facilities, handling & operations (F)	Lack of manpower (G)	Lack of strategic/tactical level planning & Decision Support System (DSS) (H)	Lack of coordination among food banks (I)	Lack of awareness about food bank (J)	Uncertainty in demand (K)	Low nutritional value in donated food (L)	Perishability and limited shelf life of food items (M)	Uncertainty in supply (N)
Low penetration of policies & regulations for donation (A)	0.156	0.195	0.272	0.229	0.250	0.266	0.247	0.270	0.254	0.267	0.250	0.209	0.251	0.234
Limited funds /commodities raised from the donation (B)	0.170	0.139	0.202	0.207	0.244	0.259	0.234	0.232	0.204	0.217	0.213	0.190	0.220	0.205
Limited financial support from the government (C)	0.238	0.223	0.203	0.265	0.300	0.310	0.295	0.295	0.279	0.272	0.256	0.231	0.276	0.252
Lack of storage (D)	0.116	0.083	0.097	0.083	0.132	0.130	0.102	0.132	0.118	0.093	0.139	0.109	0.152	0.121
Lack of transportation facilities (E)	0.160	0.162	0.181	0.181	0.138	0.180	0.163	0.172	0.202	0.171	0.186	0.168	0.192	0.178
Lack of collection and distribution facilities, handling & operations (F)	0.154	0.155	0.194	0.181	0.192	0.145	0.169	0.173	0.183	0.171	0.185	0.154	0.186	0.191
Lack of manpower (G)	0.155	0.159	0.197	0.175	0.186	0.194	0.143	0.226	0.198	0.219	0.187	0.153	0.194	0.186
Lack of strategic/tactical level planning & Decision Support System (DSS) (H)	0.222	0.252	0.265	0.236	0.252	0.269	0.261	0.218	0.268	0.256	0.258	0.210	0.278	0.241
Lack of coordination among food banks (I)	0.187	0.189	0.225	0.204	0.230	0.234	0.220	0.211	0.167	0.221	0.243	0.206	0.243	0.222

Lack of awareness about food bank (J)	0.164	0.205	0.198	0.178	0.171	0.179	0.201	0.179	0.180	0.135	0.201	0.138	0.176	0.194
Uncertainty in demand (K)	0.185	0.181	0.218	0.209	0.228	0.256	0.230	0.229	0.233	0.207	0.167	0.192	0.223	0.214
Low nutritional value in donated food (L)	0.133	0.155	0.180	0.173	0.177	0.211	0.181	0.177	0.188	0.176	0.191	0.112	0.178	0.184
Perishability and limited shelf life of food items (M)	0.174	0.170	0.192	0.189	0.221	0.223	0.198	0.215	0.206	0.187	0.221	0.168	0.154	0.207
Uncertainty in supply (N)	0.188	0.183	0.232	0.191	0.211	0.240	0.227	0.219	0.209	0.197	0.235	0.168	0.217	0.154

Table A-4: Unweighted supermatrix Z_s for sub-barriers

Barriers code		(B1)	(B2)		(B3)				(B4)		(B5)	(B6)	(B7)		
Barriers code	Sub-barriers	Low penetration of policies & regulations for donation (A)	Limited funds /commodities raised from the donation (B)	Limited financial support from the government (C)	Lack of storage (D)	Lack of transportation facilities (E)	Lack of collection and distribution facilities, handling & operations (F)	Lack of manpower (G)	Lack of strategic/tactical level planning & Decision Support System (DSS) (H)	Lack of coordination among food banks (I)	Lack of awareness about food bank (J)	Uncertainty in demand (K)	Low nutritional value in donated food (L)	Perishability and limited shelf life of food items (M)	Uncertainty in supply (N)
(B1)	Low penetration of policies & regulations for donation (A)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
(B2)	Limited funds /commodities raised from the donation (B)	0.42	0.41	0.52	0.46	0.47	0.44	0.45	0.49	0.46	0.51	0.45	0.46	0.47	0.44
	Limited financial support from the government (C)	0.58	0.59	0.48	0.54	0.53	0.56	0.55	0.51	0.54	0.49	0.55	0.54	0.53	0.56
(B3)	Lack of storage (D)	0.23	0.22	0.23	0.19	0.27	0.26	0.25	0.23	0.23	0.24	0.23	0.23	0.23	0.22
	Lack of transportation facilities (E)	0.25	0.26	0.26	0.29	0.21	0.28	0.27	0.25	0.26	0.23	0.25	0.24	0.27	0.24
	Lack of collection and distribution facilities, handling & operations (F)	0.27	0.27	0.26	0.29	0.27	0.21	0.28	0.26	0.26	0.25	0.28	0.28	0.27	0.28
	Lack of manpower (G)	0.25	0.25	0.25	0.23	0.25	0.25	0.21	0.26	0.25	0.28	0.25	0.24	0.24	0.26
(B4)	Lack of strategic/tactical level planning & Decision Support System (DSS) (H)	0.52	0.53	0.51	0.53	0.46	0.49	0.53	0.45	0.56	0.50	0.50	0.49	0.51	0.51
	Lack of coordination among food banks (I)	0.48	0.47	0.49	0.47	0.54	0.51	0.47	0.55	0.44	0.50	0.50	0.51	0.49	0.49

(B5)	Lack of awareness about food bank (J)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
(B6)	Uncertainty in demand (K)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
(B7)	Low nutritional value in donated food (L)	0.30	0.31	0.30	0.29	0.31	0.29	0.29	0.29	0.31	0.27	0.31	0.24	0.32	0.31
	Perishability and limited shelf life of food items (M)	0.36	0.36	0.36	0.40	0.36	0.35	0.36	0.38	0.36	0.35	0.35	0.38	0.29	0.40
	Uncertainty in supply (N)	0.34	0.33	0.33	0.32	0.33	0.36	0.35	0.33	0.33	0.38	0.34	0.39	0.39	0.29

Table A-5: The normalized matrix U_B and weight matrix W_B for barriers

Initial Direct Influence Matrix							
Barriers	Policy (B1)	Financial (B2)	Infrastructure & HR (B3)	Planning & Coordination (B4)	Knowledge (B5)	Uncertainty (B6)	Characteristics of donated food (B7)
Policy (B1)	0.119	0.141	0.141	0.138	0.140	0.137	0.142
Financial (B2)	0.161	0.133	0.153	0.156	0.157	0.152	0.159
Infrastructure & HR (B3)	0.156	0.156	0.132	0.157	0.148	0.157	0.156
Planning & Coordination (B4)	0.151	0.153	0.150	0.129	0.150	0.156	0.157
Knowledge (B5)	0.133	0.135	0.137	0.138	0.115	0.136	0.129
Uncertainty (B6)	0.140	0.138	0.143	0.141	0.149	0.120	0.136
Characteristics of donated food (B7)	0.136	0.140	0.141	0.138	0.138	0.139	0.118
Normalized Direct Influence matrix							
Barriers	Policy (B1)	Financial (B2)	Infrastructure & HR (B3)	Planning & Coordination (B4)	Knowledge (B5)	Uncertainty (B6)	Characteristics of donated food (B7)
Policy (B1)	0.119	0.161	0.156	0.151	0.133	0.140	0.136
Financial (B2)	0.141	0.133	0.156	0.153	0.135	0.138	0.140
Infrastructure & HR (B3)	0.141	0.153	0.132	0.150	0.137	0.142	0.141
Planning & Coordination (B4)	0.138	0.156	0.157	0.129	0.138	0.141	0.138
Knowledge (B5)	0.140	0.157	0.148	0.150	0.115	0.149	0.138
Uncertainty (B6)	0.137	0.152	0.157	0.156	0.136	0.120	0.139
Characteristics of donated food (B7)	0.142	0.159	0.156	0.157	0.129	0.136	0.118

Table A-6: Weighted supermatrix, W for sub-barriers

Barriers code		(B1)	(B2)		(B3)			(B4)		(B5)	(B6)	(B7)			
Barriers code	Sub-barriers	Low penetration of policies & regulations for donation (A)	Limited funds /commodities raised from the donation (B)	Limited financial support from the government (C)	Lack of storage (D)	Lack of transportation facilities (E)	Lack of collection and distribution facilities, handling & operations (F)	Lack of manpower (G)	Lack of strategic/tactical level planning & Decision Support System (DSS) (H)	Lack of coordination among food banks (I)	Lack of awareness about food bank (J)	Uncertainty in demand (K)	Low nutritional value in donated food (L)	Perishability and limited shelf life of food items (M)	Uncertainty in supply (N)
(B1)	Low penetration of policies & regulations for donation (A)	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
(B2)	Limited funds /commodities raised from the donation (B)	0.07	0.05	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.08	0.07	0.07	0.07	0.07
	Limited financial support from the government (C)	0.09	0.08	0.06	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.09
(B3)	Lack of storage (D)	0.04	0.03	0.04	0.02	0.04	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.03
	Lack of transportation facilities (E)	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.04
	Lack of collection and distribution facilities, handling & operations (F)	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	Lack of manpower (G)	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04
(B4)	Lack of strategic/tactical level planning & Decision Support System (DSS) (H)	0.08	0.08	0.08	0.08	0.07	0.07	0.08	0.06	0.07	0.07	0.08	0.08	0.08	0.08
	Lack of coordination among food banks (I)	0.07	0.07	0.07	0.07	0.08	0.08	0.07	0.07	0.06	0.08	0.08	0.08	0.08	0.08

(B5)	Lack of awareness about food bank (J)	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.14	0.13	0.13	0.13
(B6)	Uncertainty in demand (K)	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.12	0.14	0.14	0.14
(B7)	Low nutritional value in donated food (L)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04
	Perishability and limited shelf life of food items (M)	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.03	0.05
	Uncertainty in supply (N)	0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Appendix B

Table B-1: The results of GA, GA_LS_1, GA_LS_2 and effectiveness score of sub-class ID-2 to sub-class ID-9

Instances	GA				GA_LS_1				GA_LS_2				A (%)	B(%)	C (%)
	Best solution		Average values		Best solution		Average values		Best solution		Average values				
	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)			
p1_2	59348	1249	59592	1414	55492	2059	56101	2196	52232	3937	52454	4274	11.99	6.50	5.87
p2_2	57927	3037	58123	3133	55196	3124	55687	3274	50820	6874	51042	7205	12.27	4.72	7.93
p3_2	95366	3624	95520	3871	92549	4378	93193	4646	87946	8621	88167	8901	7.78	2.95	4.97
p4_2	94614	4890	94989	5183	92079	5707	92568	6004	87029	12310	87250	12525	8.02	2.68	5.48
p5_2	51836	8022	51958	8109	51673	9139	51918	9374	42346	16271	42567	16467	18.31	0.32	18.05
p6_2	105554	10144	105603	10333	103775	14012	104057	14312	95421	20739	95643	21010	9.60	1.69	8.05
p7_2	88252	1877	88650	2132	84411	3002	85343	3166	80923	4886	81145	5152	8.30	4.35	4.13
p8_2	79160	3859	79347	4016	74158	4678	74730	4912	71225	8609	71446	8956	10.02	6.32	3.96
p9_2	109271	7235	109565	7475	106704	7553	107491	7705	100440	14894	100662	15207	8.08	2.35	5.87
p10_2	101974	11396	102585	11535	98152	12347	99290	12661	91920	20485	92142	20853	9.86	3.75	6.35
p11_2	59503	1328	59604	1549	57879	2079	58128	2376	52520	3901	52742	4129	11.74	2.73	9.26
p12_2	58166	2938	58323	3124	57107	2602	57711	2752	50955	6873	51177	7171	12.40	1.82	10.77
p13_2	97183	4772	97565	5008	91283	3973	91938	4254	88470	10481	88692	10745	8.96	6.07	3.08
p14_2	97343	5599	97660	5695	95402	6254	96233	6528	88020	12928	88242	13138	9.58	1.99	7.74
p15_2	53128	7894	53911	8174	51033	9468	52575	9758	43330	16945	43552	17128	18.44	3.94	15.09
p16_2	107542	9722	107846	9843	105140	13892	105701	14028	97178	20657	97399	20869	9.64	2.23	7.57
p17_2	88934	2237	89426	2422	86694	2137	88098	2369	81195	4997	81417	5354	8.70	2.52	6.34
p18_2	80072	3245	80324	3484	77038	5192	77752	5379	71428	7665	71649	7892	10.80	3.79	7.28
p19_2	109799	7861	110677	8018	105032	8484	106255	8690	100643	15551	100865	15798	8.34	4.34	4.18

Instances	GA				GA_LS_1				GA_LS_2				A (%)	B(%)	C (%)
	Best solution		Average values		Best solution		Average values		Best solution		Average values				
	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)			
p20_2	101012	11352	101366	11459	97007	11215	97609	11389	91221	21267	91442	21470	9.69	3.96	5.96
p1_3	41707	1264	41950	1439	38034	2001	38455	2114	35112	4150	35333	4336	15.81	8.81	7.68
p2_3	31752	2075	31948	2363	30052	2737	30570	2850	26467	6609	26662	6820	16.65	5.35	11.93
p3_3	55944	3114	56098	3327	52552	3716	53044	4028	49342	9209	49482	9463	11.80	6.06	6.11
p4_3	64679	5764	65054	5972	62921	6180	63304	6330	58491	13095	58832	13278	9.57	2.72	7.04
p5_3	76547	9152	76669	9297	73954	7816	74159	8007	69373	16778	69564	16982	9.37	3.39	6.19
p6_3	60432	10339	60480	10511	58815	13123	58993	13243	53369	20745	53522	21117	11.69	2.68	9.26
p7_3	99174	2045	99572	2126	95207	2695	95829	2926	92675	4482	93037	4730	6.55	4.00	2.66
p8_3	82555	4244	82741	4391	80757	4891	81196	5005	76638	7695	76807	7948	7.17	2.18	5.10
p9_3	79428	8002	79722	8154	77121	8722	77742	8860	73048	14646	73440	14842	8.03	2.90	5.28
p10_3	79373	11523	79984	11760	77629	13261	78493	13558	72755	20433	73310	20765	8.34	2.20	6.28
p11_3	42053	1251	42155	1544	38233	2045	38396	2238	35336	4027	35482	4385	15.97	9.08	7.58
p12_3	31793	1362	31950	1454	29526	2766	30046	3029	26595	7216	26690	7539	16.35	7.13	9.93
p13_3	56327	3455	56710	3643	53169	5000	53636	5247	49691	9780	50039	10138	11.78	5.61	6.54
p14_3	65696	5934	66012	6135	63592	5472	64167	5639	59415	13258	59719	13587	9.56	3.20	6.57
p15_3	76145	8559	76928	8803	74347	9239	75425	9478	69108	16466	69819	16655	9.24	2.36	7.05
p16_3	60570	9621	60874	9769	58879	13729	59373	14015	53676	20892	53952	21135	11.38	2.79	8.84
p17_3	99446	1783	99938	2041	95870	2558	96900	2865	92923	5698	93370	6038	6.56	3.60	3.07
p18_3	82582	4878	82834	5167	80515	5532	81012	5707	76662	7779	76891	8093	7.17	2.50	4.79
p19_3	79482	6858	80359	7002	77569	8161	78456	8350	73277	15466	74075	15656	7.81	2.41	5.53
p20_3	78563	11407	78917	11701	76790	11520	77324	11796	72019	21921	72340	22180	8.33	2.26	6.21
p1_4	2198	1249	2333	1502	2145	2154	2427	2321	1971	4130	2253	4330	10.34	2.41	8.13
p2_4	2489	2546	2728	2732	2303	3910	2794	4074	2263	7076	2498	7300	9.09	7.49	1.73
p3_4	2716	3294	2966	3550	2597	4328	3157	4543	2469	9787	2697	10096	9.09	4.36	4.94
p4_4	3179	5607	3355	5757	2997	5745	3423	6004	2890	13013	3050	13253	9.09	5.73	3.57

Instances	GA				GA_LS_1				GA_LS_2				A (%)	B(%)	C (%)
	Best solution		Average values		Best solution		Average values		Best solution		Average values				
	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)			
p5_4	4636	8318	4891	8515	4688	8714	4945	8844	4214	16681	4446	17031	9.09	-1.12	10.10
p6_4	4476	10144	4703	10422	4734	13408	4974	13724	4069	20054	4276	20418	9.09	-5.77	14.05
p7_4	2804	2014	3155	2217	2787	2053	3333	2296	2367	5329	2831	5623	15.58	0.61	15.06
p8_4	3519	4505	3612	4611	3324	5010	3658	5204	2535	6685	3060	7029	27.95	5.54	23.73
p9_4	3516	7084	3875	7370	3459	8198	4011	8453	2933	16134	3347	16396	16.59	1.62	15.22
p10_4	5093	11544	5710	11805	5196	13731	5826	13955	4630	20776	5191	21128	9.09	-2.03	10.90
p11_4	2234	1456	2424	1630	2259	2189	2452	2320	2031	4639	2204	4950	9.09	-1.12	10.10
p12_4	2467	2501	2778	2656	2235	4140	2851	4263	2461	7191	2587	7446	0.23	9.41	-10.14
p13_4	3314	3859	3624	4058	3351	4899	3664	5038	3013	8764	3294	8943	9.09	-1.12	10.10
p14_4	3893	5785	4316	5964	4117	6247	4565	6386	3539	12291	3923	12597	9.09	-5.77	14.05
p15_4	4303	7894	5070	8144	4606	9027	5426	9322	3912	16737	4609	17003	9.09	-7.03	15.06
p16_4	4881	9022	5197	9186	5202	13714	5539	13920	4437	21825	4725	22096	9.09	-6.57	14.70
p17_4	2872	2454	3490	2748	3212	2593	3903	2747	2611	4797	3173	5064	9.09	-11.82	18.70
p18_4	3152	4585	3510	4714	3216	4071	3581	4299	2866	8457	3191	8725	9.09	-2.03	10.90
p19_4	3760	7787	4315	7899	3802	8189	4363	8347	3418	14513	3922	14733	9.09	-1.12	10.10
p20_4	4056	11666	4574	11847	4290	13171	4838	13368	3687	21425	4158	21664	9.09	-5.77	14.05
p1_5	39032	2141	39236	2400	42178	2526	42599	2793	44199	3772	44481	3974	-13.24	-8.06	-4.79
p2_5	40582	3053	40745	3168	41504	3357	42022	3561	45597	6887	45878	7104	-12.36	-2.27	-9.86
p3_5	77006	3225	77134	3487	80903	4288	81395	4443	81717	9487	81999	9726	-6.12	-5.06	-1.01
p4_5	79223	4497	79536	4627	81152	6305	81535	6478	83800	11579	84082	11836	-5.78	-2.43	-3.26
p5_5	34426	7505	34527	7593	36749	9751	36954	9957	37117	18181	37399	18402	-7.82	-6.75	-1.00
p6_5	90343	10144	90383	10428	91028	14040	91206	14255	92193	20545	92475	20869	-2.05	-0.76	-1.28
p7_5	67946	2157	68278	2351	71833	3007	72455	3248	72694	3963	72976	4203	-6.99	-5.72	-1.20
p8_5	64750	3119	64906	3289	67251	5266	67690	5522	68996	7129	69278	7482	-6.56	-3.86	-2.59
p9_5	89831	6469	90075	6642	91639	8792	92259	8990	93211	16375	93493	16669	-3.76	-2.01	-1.72

Instances	GA				GA_LS_1				GA_LS_2				A (%)	B(%)	C (%)
	Best solution		Average values		Best solution		Average values		Best solution		Average values				
	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)			
p10_5	83869	11396	84378	11600	84966	12678	85830	12794	85692	21067	85974	21372	-2.17	-1.31	-0.85
p11_5	39287	1339	39372	1521	40496	2646	40659	2789	44291	3854	44573	4149	-12.74	-3.08	-9.37
p12_5	40921	2987	41052	3227	43466	3597	43986	3907	45726	6392	46009	6747	-11.74	-6.22	-5.20
p13_5	78922	3120	79241	3232	78275	4354	78742	4494	82242	8798	82524	9110	-4.21	0.82	-5.07
p14_5	82018	5599	82281	5882	82043	6428	82618	6596	84792	13780	85074	14105	-3.38	-0.03	-3.35
p15_5	35782	8596	36434	8800	36425	10895	37503	11104	38101	16898	38384	17082	-6.48	-1.80	-4.60
p16_5	92311	9943	92564	10143	91056	14284	91551	14479	93949	20656	94231	21013	-1.77	1.36	-3.18
p17_5	68618	2237	69028	2394	69953	3105	70983	3304	72967	4583	73249	4951	-6.34	-1.95	-4.31
p18_5	65863	4131	66073	4312	65128	5573	65625	5883	69199	7187	69481	7389	-5.06	1.12	-6.25
p19_5	90431	7143	91163	7302	89753	8983	90640	9199	93415	15780	93697	16005	-3.30	0.75	-4.08
p20_5	82798	11659	83093	11924	81303	12927	81837	13166	84992	21458	85274	21689	-2.65	1.81	-4.54
p1_6	34683	1456	34818	1723	31001	2062	31283	2385	28063	3715	28345	3918	19.09	10.62	9.48
p2_6	29515	2088	29753	2306	27852	3734	28342	3987	24250	7506	24485	7732	17.84	5.63	12.93
p3_6	48705	3352	48956	3622	45646	4116	45806	4253	42126	9771	42354	9979	13.51	6.28	7.71
p4_6	57769	4960	57945	5071	56012	5317	56192	5473	51573	13492	51732	13840	10.73	3.04	7.93
p5_6	74366	7965	74621	8220	71893	8479	72151	8599	67309	17035	67540	17399	9.49	3.33	6.38
p6_6	51953	10144	52181	10390	50520	13435	50761	13638	45116	21421	45323	21739	13.16	2.76	10.70
p7_6	94073	1894	94423	1997	90160	2980	90707	3104	87401	3836	87865	4121	7.09	4.16	3.06
p8_6	81741	3859	81834	4062	80829	5039	81163	5164	76143	7896	76668	8252	6.85	1.12	5.80
p9_6	74287	7406	74646	7524	71942	8570	72493	8739	67836	15563	68249	15868	8.68	3.16	5.71
p10_6	76304	10838	76921	10962	74859	13505	75489	13795	69692	21504	70253	21691	8.67	1.89	6.90
p11_6	34719	1279	34909	1465	30997	2235	31189	2428	28123	3897	28296	4167	19.00	10.72	9.27
p12_6	29493	2390	29803	2573	27295	3229	27911	3502	24449	7873	24574	8160	17.10	7.45	10.43
p13_6	49304	3649	49613	3735	46245	4536	46558	4738	42670	10238	42951	10544	13.46	6.20	7.73
p14_6	58483	6094	58905	6279	56667	5728	57114	5979	52222	11890	52606	12214	10.71	3.10	7.84

Instances	GA				GA_LS_1				GA_LS_2				A (%)	B(%)	C (%)
	Best solution		Average values		Best solution		Average values		Best solution		Average values				
	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)			
p15_6	74034	8017	74800	8137	72528	9259	73348	9480	67006	16734	67703	17003	9.49	2.03	7.61
p16_6	52359	9358	52675	9632	51024	13150	51361	13320	45484	21387	45772	21599	13.13	2.55	10.86
p17_6	94141	2606	94759	2862	91129	3480	91820	3659	87645	3859	88207	4161	6.90	3.20	3.82
p18_6	81374	4305	81732	4410	80603	5337	80968	5645	76474	7028	76799	7391	6.02	0.95	5.12
p19_6	74531	7143	75085	7235	72618	8185	73178	8419	68321	15964	68825	16162	8.33	2.57	5.92
p20_6	75267	10998	75785	11233	73777	11991	74325	12265	68750	20816	69221	21068	8.66	1.98	6.81
p1_7	3080	1866	3337	2039	3006	2019	3336	2189	2553	3654	2833	3887	17.11	2.41	15.06
p2_7	3366	1541	3596	1633	3232	2449	3719	2577	2630	7973	3147	8184	21.87	4.00	18.61
p3_7	3462	3624	3705	3839	3871	3963	4143	4117	3147	8459	3368	8684	9.09	-11.82	18.70
p4_7	3728	5138	4107	5391	3645	5074	4150	5196	3248	12675	3698	13026	12.88	2.22	10.90
p5_7	5703	8033	5931	8227	5640	8220	5694	8449	5071	17290	5119	17647	11.09	1.10	10.10
p6_7	5775	10144	6461	10364	5748	13699	5916	13932	5123	20543	5365	20903	11.29	0.46	10.88
p7_7	3935	1575	4166	1684	3894	2652	4288	2895	3307	5810	3642	6065	15.96	1.06	15.06
p8_7	4308	4430	4531	4605	4295	5321	4381	5511	3664	8573	3737	8760	14.95	0.29	14.70
p9_7	4755	7091	4867	7327	4366	7853	4990	8156	3956	14973	4235	15232	16.81	8.17	9.41
p10_7	5943	11072	6432	11355	5860	13269	6481	13407	5221	20587	5774	20926	12.15	1.40	10.90
p11_7	3183	1977	3248	2200	3066	2629	3244	2935	2756	3825	2916	4196	13.43	3.70	10.10
p12_7	3481	2895	3638	3016	3221	3358	3620	3513	2852	6004	3158	6227	18.08	7.47	11.46
p13_7	4321	4413	4545	4616	3947	3989	4394	4108	3249	10243	3870	10506	24.82	8.66	17.70
p14_7	4674	6129	5033	6236	4943	5563	5323	5689	4249	12985	4575	13250	9.09	-5.77	14.05
p15_7	5034	7769	5807	7908	5388	8626	6215	8865	4576	16879	5279	17077	9.09	-7.03	15.06
p16_7	5592	9722	6033	9909	5460	13338	6329	13583	5084	21052	5484	21290	9.09	2.37	6.89
p17_7	4419	2624	4605	2889	3883	3750	4126	3996	3563	6022	4005	6255	19.38	12.15	8.23
p18_7	4479	3436	4580	3685	4010	4630	4344	4778	3573	8125	3870	8463	20.22	10.46	10.90
p19_7	5234	7829	5603	8071	4282	8982	5261	9106	3849	16294	4730	16550	26.46	18.20	10.10

Instances	GA				GA_LS_1				GA_LS_2				A (%)	B(%)	C (%)
	Best solution		Average values		Best solution		Average values		Best solution		Average values				
	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)			
p20_7	5437	10811	5530	10957	5390	11104	5658	11368	4633	21372	4863	21738	14.79	0.86	14.05
p1_8	66432	1253	66689	1358	63834	2010	64211	2209	60929	4197	61210	4411	8.28	3.91	4.55
p2_8	64837	2088	65066	2353	62179	2546	62660	2764	59065	7436	59346	7635	8.90	4.10	5.01
p3_8	102342	2716	102585	2986	95878	3907	96188	4025	93191	9673	93472	9891	8.94	6.32	2.80
p4_8	101802	4312	102181	4403	98759	6103	99291	6303	94274	13285	94555	13597	7.39	2.99	4.54
p5_8	59747	8318	59974	8600	51178	8770	51232	8921	45591	16270	45872	16492	23.69	14.34	10.92
p6_8	114180	9548	114866	9837	110427	13838	110619	14163	106667	21568	106947	21942	6.58	3.29	3.40
p7_8	95739	1575	95970	1838	92862	2464	93333	2602	90168	5438	90449	5662	5.82	3.01	2.90
p8_8	86969	3859	87193	4035	82507	4227	82625	4363	79470	8651	79751	8892	8.62	5.13	3.68
p9_8	117956	6705	118068	6924	112895	8721	113543	8862	105685	14898	105966	15197	10.40	4.29	6.39
p10_8	111878	11396	112367	11520	103051	12484	103741	12713	99166	20108	99446	20335	11.36	7.89	3.77
p11_8	66253	1339	66318	1552	63878	2017	64047	2179	61765	4647	62046	4863	6.77	3.59	3.31
p12_8	65448	2085	65605	2367	62222	3394	62641	3719	59200	6623	59481	6879	9.55	4.93	4.86
p13_8	106167	3318	106391	3484	99522	4499	100016	4770	93716	9327	93996	9646	11.73	6.26	5.83
p14_8	106237	6285	106597	6410	100736	5589	101181	5723	95266	11772	95546	12035	10.33	5.18	5.43
p15_8	62530	7633	63302	7844	55402	9433	56345	9580	46575	17160	46856	17419	25.52	11.40	15.93
p16_8	117677	9448	118117	9737	110841	13308	111724	13575	108423	21750	108704	21990	7.86	5.81	2.18
p17_8	97032	2237	97218	2431	93028	3137	93364	3340	90441	5218	90721	5594	6.79	4.13	2.78
p18_8	89111	4494	89212	4677	83520	5173	83904	5498	79673	8743	79954	8981	10.59	6.27	4.61
p19_8	119457	7808	119825	8031	109005	8824	110068	9054	105889	15605	106169	15986	11.36	8.75	2.86
p20_8	110959	10605	111051	10852	104419	11498	104696	11619	98466	21753	98746	22091	11.26	5.89	5.70
p1_9	43565	1276	43822	1466	39862	2322	40192	2492	36645	3847	36925	4028	15.88	8.50	8.07
p2_9	34392	2851	34621	3126	32780	3379	33267	3539	28617	6203	29134	6499	16.79	4.69	12.70
p3_9	62452	2837	62695	2974	59520	3377	59792	3553	55804	9000	56025	9270	10.64	4.69	6.24
p4_9	69317	4794	69697	5010	67414	6403	67919	6543	62930	11962	63380	12315	9.21	2.75	6.65

Instances	GA				GA_LS_1				GA_LS_2				A (%)	B(%)	C (%)
	Best solution		Average values		Best solution		Average values		Best solution		Average values				
	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)	Obj. value	CPU(s)			
p5_9	82434	7564	82661	7772	79846	7871	79899	8172	75165	17888	75213	18242	8.82	3.14	5.86
p6_9	67253	10604	67939	10697	65535	13062	65702	13329	60170	21492	60412	21830	10.53	2.55	8.19
p7_9	105204	1489	105435	1706	101267	3111	101661	3310	98341	4341	98676	4657	6.52	3.74	2.89
p8_9	93530	3998	93754	4170	91801	5119	91887	5270	87272	6728	87346	7005	6.69	1.85	4.93
p9_9	90525	6634	90637	6863	87849	7866	88472	7998	83858	14482	84138	14828	7.36	2.96	4.54
p10_9	85154	12251	85643	12461	83523	13665	84144	13964	78283	21472	78837	21698	8.07	1.92	6.27
p11_9	43668	1305	43733	1483	39803	2011	39981	2192	36848	4339	37008	4683	15.62	8.85	7.42
p12_9	34507	1450	34663	1734	32281	3513	32680	3786	28839	7549	29146	7902	16.42	6.45	10.66
p13_9	63311	3997	63535	4141	59841	5173	60288	5460	55906	8643	56527	8824	11.70	5.48	6.58
p14_9	70263	6060	70623	6208	68492	5922	68873	6096	63931	11769	64258	12113	9.01	2.52	6.66
p15_9	81764	8749	82537	9020	80310	9353	81137	9650	74671	16326	75373	16612	8.68	1.78	7.02
p16_9	67070	9313	67510	9600	65282	13566	66151	13880	60131	21358	60531	21536	10.35	2.67	7.89
p17_9	105688	2935	105874	3092	101800	3202	102043	3333	98597	5467	99039	5767	6.71	3.68	3.15
p18_9	93701	4911	93802	5170	91398	4678	91731	4952	87182	8209	87479	8469	6.96	2.46	4.61
p19_9	91005	7541	91373	7643	88097	8418	89076	8738	83752	14488	84632	14863	7.97	3.19	4.93
p20_9	84648	10157	84741	10433	82878	11558	83145	11871	77696	20790	77926	21112	8.21	2.09	6.25
Average score for performance of different algorithms for subclass-ID-1 to subclass-ID-9												8.74*	2.24*	6.67*	

A= The effectiveness score of elitist GA over GA_LS_2; B= The effectiveness score of elitist GA over GA_LS_1; C= The effectiveness score of GA_LS_1 over GA_LS_2

Table B-2: The latitude, longitude, service time and demand of pickup and delivery locations

Id	Latitude	Longitude	Service Time	Demand				
				S-1	S-2	S-3	S-4	S-5
Depo 1	26.85136641	81.00535733	0	0	0	0	0	0
Depo 2	26.88314636	80.99229841	0	0	0	0	0	0
Depo 3	26.81300341	80.90005291	0	0	0	0	0	0
1	26.78372025	80.90142609	15	55	170	170	55	55
2	26.80010761	80.89541789	3	10	100	100	10	10
3	26.88825614	80.99582769	3	11	164	164	11	11
4	26.87474287	80.98161477	19	67	118	118	67	67
5	26.79317622	80.91234672	21	74	36	36	74	74
6	26.81377495	80.90202303	11	39	4	54	39	39
7	26.84082222	80.87763575	18	65	4	20	65	65
8	26.83286474	80.9215466	10	36	156	156	36	36
9	26.84086306	80.8772858	3	11	146	146	11	11
10	26.84080965	80.87997916	8	29	118	118	29	29
11	26.89357326	80.95046642	21	77	100	100	77	77
12	26.84904711	80.99054588	25	89	140	140	89	89
13	26.85029121	80.98811039	10	35	196	196	35	35
14	26.85932911	80.99729814	22	80	172	172	80	80
15	26.85354667	81.01031783	9	31	50	50	31	31
16	26.85093828	81.00752748	20	73	166	166	73	73
17	26.85266071	81.00332177	11	40	82	82	40	40
18	26.86161373	81.01021167	20	73	32	32	73	73
19	26.85028	81.00730434	4	14	161	161	14	14
20	26.8518583	81.00826974	11	38	12	12	38	38
21	26.85252553	80.99849177	4	13	110	110	13	13
22	26.85165211	81.02381695	25	92	4	4	92	92
23	26.86553724	80.99667322	4	13	186	186	13	13
24	26.84784883	80.985512	20	72	54	54	72	72
25	26.86114996	80.90453678	17	61	104	104	61	61
26	26.85144564	81.00823494	11	-53	-53	-53	-66	-38

27	26.85254667	81.00803178	17	-82	-82	-82	-41	-40
28	26.8350924	81.0011616	4	-18	-18	-18	-32	-44
29	26.87407399	81.01575202	28	-134	-134	-134	-75	-21
30	26.88646759	80.99343598	3	-10	-10	-10	-37	-66
31	26.86984618	80.98893437	30	-147	-147	-147	-36	-31
32	26.87448433	80.9737677	27	-130	-130	-130	-70	-21
33	26.93698987	80.94241263	20	-94	-94	-94	-68	-29
34	26.86745299	80.95657792	29	-140	-140	-140	-44	-39
35	26.87009697	80.997208	30	-143	-143	-143	-13	-13
36	26.91166952	80.94468377	23	-110	-110	-110	-30	-57
37	26.88450351	80.98047134	24	-115	-115	-115	-11	-11
38	26.88139208	80.97943531	14	-64	-64	-64	-66	-48
39	26.83137314	80.92451045	9	-43	-43	-43	-38	-17
40	26.8978834	80.9688189	10	-49	-49	-49	-31	-56
41	26.91062355	80.94868683	7	-30	-30	-30	-50	-6
42	26.87311404	80.98259867	13	-59	-59	-59	-74	-5
43	26.88269982	80.9485788	27	-132	-132	-132	-57	-45
44	26.87014668	80.99730081	17	-82	-82	-82	-9	-22
45	26.80109655	80.89591205	13	-62	-62	-62	-74	-23
46	26.79871717	80.8969707	29	-138	-138	-138	-35	-54
47	26.87389443	80.95678548	21	-100	-100	-100	-33	-69
48	26.86169665	80.97909857	28	-137	-137	-137	-39	-13
49	26.78071479	80.95590636	20	-98	-98	-98	-11	-53
50	26.87078049	81.02091507	17	-79	-79	-79	-14	-26
51	26.83938107	80.99819633	27	-129	-129	-129	-19	-7
52	26.8805039	81.03416608	6	-29	-29	-29	-21	-34
53	26.84745956	80.910896	22	-105	-105	-105	-54	-52
54	26.77598882	80.90842084	15	-73	-73	-73	-50	-45

Appendix C

Excerpts from interview with Food Bank executive on configuration details of Food Banks

Let's delve into our working process, where we approach things from both the partnership perspective and the representative aspect. I'm responsible for leading the partnership team, ensuring that all the necessary needs are met. Furthermore, I've reached out to our management team in Delhi and successfully obtained the essential data. As of now, we possess comprehensive data for all the locations in Delhi where we have observed food insecurity.

We opened an excel sheet that contains all the details from donor, beneficiaries, volunteers and capacities. We started discussing each part one by one to deeply understand all the inherent characteristics of their humanitarian supply chain, their process, modus operandi and frequency of collection and distribution drives. Below paragraphs outline the obtained details.

In our efforts, we have focused on approximately 63 slum areas where we have observed consistent hunger and malnutrition. These observations occur either on a daily or weekly basis, depending on the specific needs of each location. To illustrate, let's consider the first one in Park East Delhi, where approximately 500 to 600 people reside. In these areas, we are actively engaged in distributing food to benefit the local residents. If we define one beneficiary as an individual, and their demand as one unit, then the estimated demand at this particular location ranges from 500 to 600 units.

I'd like to mention our donor engagement aspect. I've already initiated the process of obtaining data from my partnership team, and I'll share that information with you after this call. It's important to note that we operate across various localities within a single state, as an example, in Delhi. We cover different areas within the state, including East Delhi and West Delhi. In these regions, we have a significant presence, and there might be individuals or entities assisting us with our logistical operations.

Could you please clarify whether your food distribution efforts target food banks, schools with children, orphanages, or old-age homes?

Currently, all the beneficiary details you're viewing in the excel sheet belong to hubs such as slums or clusters. We do distribute food to old-age homes, some schools where there is a need, but not on a regular basis. Additionally, we occasionally collaborate with schools. However, we do not visit government schools as they are already covered by various other government initiatives in those locations. The data you're currently accessing pertains to our activities in these areas.

These specific locations we serve are not currently covered by any NGO, making them entirely dependent on our assistance. Due to their unique circumstances, we prioritize these areas. This includes old-age homes, orphanages, and occasionally, special camps. To address their needs comprehensively, we conduct special drives in these locations, typically once or twice a month. These efforts go beyond mere food distribution; we also engage in various activities and awareness campaigns tailored to the specific requirements at the time. For example, we might organize hygiene drives or celebrate special occasions with the volunteers or senior citizens in old-age homes.

Could you please provide some details about the types of food donations you receive and their estimated frequency? Specifically, I'm interested in understanding the collaborations you have with various entities such as Maggi, KFC, supermarkets, food industries like Britannia, Unilever, and others.

We've established partnerships with a wide range of businesses, including Growers Healthy, City Walk, Maggi, KFC, and numerous restaurants. These partnerships fall into two categories. Firstly, there's the surplus food category, where we don't impose any specific food menu requirements. These partners simply give us a call, and we arrange for volunteers to pick up and distribute the food. In this category, we accept any type of food donation. Secondly, there's the packaged food category, which includes items with extended shelf life. Yes, we do distribute such packaged foods as well.

Let me provide further clarification. Suppose we partner with an organization like 'The Harvest.' In this scenario, we operate across multiple locations in Delhi. Now, it's essential to understand that having just one central pickup location can be challenging for our operations. Coordinating all thirteen locations to converge at a single point on the same day can be quite hectic. So, to streamline our efforts effectively, we prefer having multiple pickup locations across Delhi, especially if our operations are scattered throughout the city. This approach makes it much more manageable for our local chapters and dedicated volunteers to pick up donations from various sources. In practice, this means we don't necessarily rely on a centralized warehouse for food pickups. Instead, we attempt to distribute the pickups across multiple locations whenever feasible. However, in cases where this isn't possible, our primary goal remains the same: to ensure that the food reaches those in need.

Could you please provide an overview of the types of food donations you typically receive? Specifically, are you involved in collecting leftover food from hotels and restaurants?"

Yes, indeed, we do collect surplus food from hotels and restaurants.

Great. Now that we've discussed donors and beneficiaries, let's delve into the capacity aspect. Let's discuss the situation in Delhi. What measures do you take when you receive food donations, particularly if you receive a substantial quantity like a hundred kilograms of biscuits, but lack the immediate manpower to distribute it? Where do you store such food items, for instance, those packets of biscuits?"

Fortunately, during my tenure of around four to five years serving RHA, I haven't encountered a single instance where a food drive couldn't be executed due to a lack of volunteers. Our volunteer base is incredibly strong, with individuals who are genuinely dedicated to the cause. These volunteers are not politically affiliated; they're motivated by a shared purpose. For example, if we receive a food donation request from a locality, say SCB, we can quickly rally nearby volunteers. In some cases, we have up to fifty to a hundred volunteers in the vicinity who can execute a drive on the same day. This enables us to efficiently handle the received food while prioritizing food safety. We can store excess food for the next day or even the next

week, depending on the location. Currently, we don't have dedicated storage facilities or office premises as we are entirely funded by donations.

Alright, that clears up the storage aspect. So, if I understand correctly, when you receive food items with extended shelf life, you store them at volunteers' homes. Now, let's talk about transportation. Do you rely on volunteers' vehicles for both food collection and distribution?"
Yes, that's correct. We primarily use volunteers' vehicles for transportation, and we have a variety of vehicles at our disposal, including bikes and cars. Volunteers are quite versatile in this regard.

Good to know. Now, regarding storage capacity, can you provide an estimate of how many kilograms of food can be stored in the excess space at volunteers' homes? I understand this may vary depending on the type of food. For instance, if we take biscuits as an example, how much can you typically store?

We usually have the capacity to store thousands of kilograms of food in our volunteers' homes, especially in a city like Delhi.

Thousands of kilograms, that's impressive. And when it comes to transportation, you mentioned partnerships. Could you elaborate on these partnerships and how they contribute to your transportation capacity?

Absolutely. While we heavily rely on volunteers, we also recognize the importance of collaborating with other partners, particularly for transportation. For example, some ride-sharing companies have provided us with free rides in Lano City, and similar collaborations have been happening across India. These partnerships enhance our transportation capabilities and help us reach more people effectively.

In a similar vein, we actively seek out partnerships to enhance our operations. Now, regarding the carrying capacity of vehicles, let me provide some estimates. We assume that a motorbike can typically carry about 50 kilograms or 50 packets of food, requiring two people for transportation. Scooters have a similar capacity, around 50 kilograms. On the other hand, cars can accommodate approximately 100 kilograms. Do you have any specific figures for these

vehicle capacities? For our operations, we've found that around 50 kilograms works well for motorbikes and scooters. As for trucks, if we need to transport larger quantities, say around 1500 to 5,000 kilograms, we would require the use of a truck. However, currently, we don't have access to trucks, but we're open to collaboration if the opportunity arises. As for manpower, yes, our primary workforce consists of dedicated volunteers who contribute their time and effort to make our operations successful.

Let's explore the hypothetical scenario of having dedicated full-time employees, perhaps around four to five of them. How would that affect your organization's operations? I understand that RHA typically operates on a zero-fund basis, but what if, in a different scenario, the government were to provide you with an annual budget? How would you efficiently manage and allocate those funds to carry out your daily operations?

In our current policy, we don't accept monetary funds. Instead, we rely on contributions in the form of food or similar items. Monetary donations aren't a part of our approach. I believe this covers the essential details you were seeking.

List of Publications

Journals

Published:

1. Dubey, N., & Tanksale, A. (2022). A study of barriers for adoption and growth of food banks in India using hybrid DEMATEL and Analytic Network Process. *Socio-Economic Planning Sciences*, 79, 101124. <https://doi.org/10.1016/j.seps.2021.101124> (**Elsevier, SCIE, Impact Factor: 6.2**)
2. Dubey, N., & Tanksale, A. (2023). A multi-depot vehicle routing problem with time windows, split pickup and split delivery for surplus food recovery and redistribution. *Expert Systems with Applications*, 232, 120807. <https://doi.org/10.1016/j.eswa.2023.120807> (**Elsevier, SCIE, Impact Factor: 7.5**)
3. Dubey, N., & Tanksale, A. (2022). Multi-objective optimization of surplus food recovery and redistribution units in India. *International Journal of Operational Research*. DOI: 10.1504/IJOR.2023.10055079 (**Scopus, Impact Factor: 1.2**)
4. Tanksale, A., Dalal, J., & Dubey, N. (2024). Integrated foodbank network design: Model and a case study. *International Journal of Production Economics*, 109385. <https://doi.org/10.1016/j.ijpe.2024.109385> (**SCIE, Impact Factor : 9.8**)

Conferences

1. Nistha Dubey*, Ajinkya N. Tanksale. Multi-Objective Optimization of Multi-Depot Vehicle Routing Problem with Split-Delivery and Split Pickup. SOM Doctoral Colloquium-2020. XLRI-Jamshedpur India. (Received Best paper runner up prize)
2. Nistha Dubey*, Ajinkya N. Tanksale. A multi-depot vehicle routing problem with split pickup and split delivery for surplus food recovery and redistribution. ISDSI-Global 2021, December 27-29, IIM Nagpur, India.