Supplementary file number 2

Supplement to: Humanitarian aid distribution logistics with accessibility constraints: A systematic literature review

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Table S1. The link and total link strength of the top 20 occurrence keywords.

RO[a]	Keywords	Cluster Number[b]	Links[c]	Total Link Strength	Occurrences	APY[d]
Top 1	Humanitarian logistics	Purple	42	89	35	2017.51
Top 2	Network repair	Orange	19	39	8	2017.62
Top 3	Accessibility	Violet	22	35	7	2017.86
Top 4	Relief distribution	Red	24	34	9	2017.33
Top 5	Optimization	Brown	24	32	17	2016.88
Top 6	Repair crew	Orange	17	31	6	2018.33
Top 7	Resilience	Green	18	26	16	2018.88
Top 8	Emergency logistics	Red	18	24	14	2015.93
Top 9	Emergency response	Green	20	24	11	2017.09
Top 10	Emergency roadway repair	Orange	17	24	5	2017.00
Top 11	Relief scheduling	Orange	11	24	4	2018.50
Top 12	Emergency	Violet	20	22	6	2016.33
Top 13	Restoration	Violet	18	22	5	2017.80
Top 14	Allocation	Brown	17	19	4	2019.00
Top 15	Disaster relief	Violet	12	19	12	2017.67
Top 16	Model	Blue	16	18	3	2017.00
Top 17	Disaster management	Yellow	14	17	13	2016.92
Top 18	Disaster response	Purple	13	17	8	2017.38
Top 19	Repair crew routing	Violet	10	17	4	2018.00
Top 20	Repair crew scheduling	Violet	10	17	5	2018.40

Note:[a]RO: ranking order; [b]cluster number (in Figure 2); [c]Links: degree node; [d]APY: average publication year in Figure 3

Table S2. Relief distribution models.

Author(s)/Year	Constraints/decision														TPOBJ
	DM	PND	ACT	MODO	TRANS	TT	PRD	CPP	PAH	LRAH	DDAH	TFT	DINV	CL	
Rodríguez et al., (2018)	X		MA	UM	TC			MLP	X	X		FTHT	X	X	MOBJ
Rezai-Malek et al (2016)	X		UA	MM	TC, TA, TF			MLP	X	X	MDAH	FTHT	X	X	MOBJ
Vahdani et al. (2018a)	X		UA	UM	TC			MLP			MDAH	FTHG, FTHT	X		OBJ, MOBJ
Sabbaghtorkan et al. (2020)	X	X	UA	UM	TC	X		MLP					X		OBJ
Al ted and Murray (2017)	X		UA	UM	TC			MLP	X		MDAH	FTHT			OBJ
Victoria et al., (2016)	X		UA	MM	TC			MP		X		FTHG			OBJ
Ahmadi et al., (2015)	X		UA	UM	TC	X		MLP		X	MDAH			X	OBJ
Tavana et al., (2018)	X		UA	UM	TC			MP			MDAH	FTHT	X		MOBJ
Grass and Fischer, (2016)	X		UA	UM						X	MDAH				OBJ
Faiz et al., (2019)			UA	UM								FTHG			OBJ
Moreno et al., (2019)			UA	UM	TC										OBJ
Alinaghian et al., (2019)	X		UA	MM	TA			MP			DAH	FTHG			OBJ
Li et al., (2019)			UA	UM											OBJ
Zhou et al., (2017)			UA	UM	TC			MLP		X	MDAH	FTHT			MOBJ
Edrissi et al., (2015)		X	UA	UM	TC		X	MLP			DAH				OBJ
Habib et al., (2016)	X		UA	UM	TC				X	X					OBJ
Coco et al., (2020)	X		UA	UM	TC			MLP	X	X	MDAH		X	X	MOBJ
Chen et al., (2020)			UA	MM	TC, TA, TF			MLP			MDAH			X	OBJ
Oruc et al., (2018)			UA	MM	TC, TA										OBJ
Liu et al., (2019)	X	X	UA	MM	TC, TA			MP	X		MDAH	FTHG			OBJ

DM (Demand requirements), PND (Priority destination nodes), ACT (Participation of one or more stakeholders), UA (Single Actor Participation), MA (Multi-stakeholder participation), MODO (Transportation problem), UM (Unimodal Problem), MM (Multimodal Problem), TRANS (Type of transport), TC (Road transportation), TA (Air Transportation), TF (River Transportation), TT (Considering of technology), PRD (Prioritization of damaged nodes, zones or routes), CPP (Single or Multi humanitarian aid product or service), MP (Mono product or service of humanitarian aid), MLP (Multiple humanitarian aid products or services), PAH (Priority type humanitarian aid), LRAH (Limitation of resources for the delivery of humanitarian aid), DDAH (Mono or Multi - humanitarian aid depot), DAH (Mono-deposit of humanitarian aid), MDAR (Multi Depot for Humanitarian Aid), TFT (Type Transportation fleet), FTHG (homogeneous transport fleet), FTHT (Heterogeneous Transportation Fleet), DINV (Consideration of inventory levels), CL (Depot capacity), TPOBJ (Single or Multi-target or performance function), OBJ (single-objective), MOBJ (Multi-objective or multiple performance functions).

Table S3. Access restoration models.

Author(s)/Year	Constraints/decision													TPOBJ
	PND	DVT	DI	ACT	TRANS	TT	DEPRR	TRR	LRR	PRR	RRR	PRD	TPRR	TMRR	
Maya-Duque et al., (2016)	X			UA	TC		MDRR	MRR		X	X		MRUD	TRC	OBJ
Nurre and Sharkey, (2018)				UA				MRR					MRUD	TRC	OBJ
Iloglu and Albert, (2020)				UA				MLRR				X		TRC	OBJ
Maya-Duque et al., (2013)				UA	TC		MDRR	MRR	X	X	X		MRUD	TRC	OBJ
Sakuraba et al., (2016a)				UA	TC	X	MDRR	MRR	X	X	X		MRUD	TRC	OBJ
Ozdamar et al., (2014)				UA				MRR		X		X		TRC, TRV	MOBJ
Sakuraba et al., (2016b)				UA				MRR		X			MRUD	TRC	OBJ
Averbakh, (2012)				UA			MDRR	MRR						TRC	OBJ
Celik, (2016)	X	X	X	UA	TC, TA	X	MDRR	MRR		X	X	X		TRC, TRV	OBJ, MOBJ
Tuzun and Ozdamar, (2014)				UA	TC		MDRR		X			X		TRC	OBJ
Lu et al., (2016)				UA	TC		MDRR	MRR	X	X		X	MRUD	TRC	OBJ
Iloglu and Albert, (2018)				UA	TC			MRR		X	X			TRC	OBJ
Karakoc et al., (2019)	X		X	UA	TC			MRR	X	X		X	MRUD	TRC	MOBJ
Hemakumar et al., (2017)				UA				MRR				X		TRV	OBJ
Kim el al., (2018)				UA			MDRR	MRR		X	X	X	MRUD	TRC	OBJ
Yan et al., (2012)				UA	TC			MLRR		X	X		MLRUD	TRC	OBJ
Morshedlou et al., (2018)				UA	TC			MRR	X	X	X			TRV	OBJ
Nurre et al., (2012)				UA								X			OBJ
Shanshan et al., (2015)				UA	TC			MRR							OBJ
Yan et al., (2020)			X	UA	TC		MDRR	MRR				X	MRUD	TRC	OBJ
Barrera et al., (2012)				UA			MDRR	MRR						TRC	OBJ
Qin et al., (2010)				UA			MDRR	MRR						TRC	OBJ

Liberatore et al., (2014)				UA			MDRR	MRR						TRC	OBJ
Wu and Wang, (2020)				UA			MDRR	MRR						TRC	OBJ

PND (Priority destination nodes), DVT Damage or impact generated by the disaster at various points in time), DI (Damage to facilities), ACT (Participation of one or more stakeholders), UA (Single Actor Participation), MA (Multi-stakeholder participation), TRANS (Type of transport), TC (Road transportation), TA (Air Transportation), TF (River Transportation), TT (Considering of technology), DEPRR (Type of decision deposit), MDRR (Mono Depot Repair Resources), MLDRR (Multiple Repository Repair Resources), TRR (Type of resource), MRR (Mono Repair Resource), MLRR (Multiple Repair Resources), LRR (Limitation on availability of resources), PRR (Programming and allocation of repair resources), RRR (Routing repair resources), PRD (Prioritization of damaged nodes, zones or routes), TPRR (Single or Multi repair on the same node), MRUD (Mono repair at the same node), MLRUD (Multiple repairs on the same node), TMRR (Repair times), TRC (constant repair (cleaning) times), TRV (Fuzzy or stochastic repair (cleaning) times), TPOBJ (Single or Multi-target or performance function), OBJ (single-objective), MOBJ (Multi-objective or multiple performance functions).

Table S4. Access restoration and Relief distribution models.

Author(s)/Year	Constraints/decision														TPOBJ
	PND	DI	ACT	MODO	TRANS	TT	DEPRR	TRR	LRR	PRR	RRR	PRD	DDAH	TFT	DINV	
Vahdani et al., (2018b)			UA	UM	TC			MRR	X	X	X		MDAH	FTHT		MOBJ
Yan and Shih, (2009)			UA	UM	TC			MRR						FTHG		MOBJ
Sanci and Daskin, (2019)			UA	UM	TC			MRR					MDAH			OBJ
Shin et al., (2019)			UA	UM	TC		MDRR	MRR		X	X		DAH			OBJ
Aslan and Celik, (2019)			UA	UM	TC			MRR		X	X		MDAH		X	OBJ

PND (Priority destination nodes), DI (Damage to facilities), ACT (Participation of one or more stakeholders), UA (Single Actor Participation), MA (Multi-stakeholder participation), TRANS (Type of transport), TT (Considering of technology), DEPRR (Type of decision deposit), TRR (Type of resource), MRR (Mono Repair Resource), MLRR (Multiple Repair Resources), LRR (Limitation on availability of resources), PRR (Programming and allocation of repair resources), RRR (Routing repair resources), PRD (Prioritization of damaged nodes, zones or routes), DDAH (Mono or Multi - humanitarian aid depot), DAH (Mono-deposit of humanitarian aid), MDAR (Multi Depot for Humanitarian Aid), TFT (Type Transportation fleet), FTHG (homogeneous transport fleet), FTHT (Heterogeneous Transportation Fleet), DINV (Consideration of inventory levels), TPOBJ (Single or Multi-target or performance function), OBJ (single-objective), MOBJ (Multi-objective or multiple performance functions).

Table S5. Performance measures.

Performance measures	Dimension	Authors
Minimize cumulative travel cost of the entire network, Minimize total transportation cost to perform all necessary operations, Minimize total logistics cost, Minimize total operating cost, Minimize the total cost of repair.	Efficiency	Arif et al., 2020; Aslan and Celik, 2019; Chen et al., 2020; Edrissi et al., 2015; Faiz et al., 2019; Liu et al., 2019; Reddy et al., 2017), Kim et al., 2018, Sanci and Daskin, 2019
Maximize total weighted flow, Maximize total flow, Maximize network accessibility, Minimize network cleanup time, Maximize priority link upgrade, Maximize demand coverage, Minimize care time, Minimize total distribution time, Minimize total recovery time for all damaged nodes, Minimize total time demand nodes remaining inaccessible, Minimize the total aid delivery time, Minimize the total repair time, Minimize the cumulative weighted distance between demands and the nearest open facilities in the time horizon, Minimize the total distance traveled, Minimize the weighted sum of the total damage in isolation and the repair team completion time.	Efficacy	Al Theeb and Murray, 2017; Arif et al., 2020; Çelik, 2016; Chen et al., 2020; Edrissi et al., 2015; Faiz et al., 2019; Grass and Fischer, 2016; Kim et al., 2018; Liu et al., 2019; Reddy et al., 2017; Sanci and Daskin, 2019; Zhou et al., 2017, Lu et al., 2016, Reddy et al., 2017, Lin, et al., 2019, Arif, et al., 2018, Karakoc et al., 2020
Minimize total deprivation cost, Minimize total unsatisfied demand, Maximize equity.	Social welfare and equity	Al ted and Murray, 2017; Zhou et al., 2017; Coco et al., 2020; Liu et al., 2019