

An Analysis of Transportation Issues in the Related Research

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Abstract: *Transportation problem nourishes economic and social activity and is cardinal to operations research and management science. This paper presents a limited survey on various types of transportation problem with its mathematical models.*

Keywords: Transportation problem, Bottleneck Transportation Problem, Multi-objective Transportation Problem

REFERENCES

- [1]. Abbas Sayadi Bander, Vahid Morovati, and Hadi Basirzadeh, A super non-dominated point for multi-objective transportation problem, Applications and Applied Mathematics: An International Journal (AAM), 10, 2015, 544 – 551.
- [2]. Adlakha, V. and Kowalski, K., An alternative solution algorithm for certain transportation problems, IJMEST, 30, 1999, 719-728.
- [3]. Ahuja, R.K., Algorithms for minimax transportation problem, Naval Research Logistics Quarterly, 33, 1986, 725-739.
- [4]. Arsham, H and Khan AB., A Simplex-type algorithm for general transportation problems; An alternative to stepping-stone, Journal of Operational Research Society, 40, 1989, 581-590.
- [5]. Arsham, H., Postoptimality analysis of the transportation problem, Journal of the Operational Research Society, 43, 1992, 121 – 139.
- [6]. Appa G.M., The Transportation problem and its variants, Oper. Res. Q., 24, 1973, 79-99.
- [7]. Arora S.R. and Ahuja A., A paradox in a fixed charge transportation problem. Indian Journal pure appl. Math., 31, 2000, 809-822.
- [8]. A. Tkacenko. and A. Alhazov., The multiobjective bottleneck transportation problem, Computers Science Journal of Moldova, Kishinev, 9, 2001, 321 – 335.
- [9]. Tkacenko., The generalized algorithm for solving the fractional multi-objective transportation problem, ROMAI J., 2, 2006, 197 – 202.
- [10]. Ali. I., Raghav, Y.S., and Bari, A., Integer goal programming approach for finding a compromise allocation of repairable components, International Journal of Engineering Science and Technology, 3, 2011a, 184-195.
- [11]. Ali. I., Raghav, Y.S., and Bari, A., Compromise allocation in multivariate stratified surveys with stochastic quadratic cost function, Journal of Statistical computation and Simulation, 83, 2011b, 960-974.
- [12]. Ammar. E. E. and Youness, E. A., Study on multi-objective transportation problem with fuzzy numbers, Applied Math and Computation, 166, 2005, 241–253.
- [13]. Bazaraa. M.S., Jarvis, J.J., and Sherali, H.D., Linear programming and Network flows, John Wiley and Sons, New York, 1997.
- [14]. Bhatia. H.L., Kanti Swaroop and M.C. Puri., A procedure for time minimization transportation problem, 7th Annual Conference of ORSI at Kanpur, 1974.
- [15]. Bit. A. K. and Alam, S. S., An additive fuzzy programming model for multi-objective transportation problem, Fuzzy Sets and Systems, 57, 1993, 313-319.

- [16]. Bit, AK, Biswal MP, Alam, SS., Fuzzy programming approach to multicriteria decision making transportation problem, *Fuzzy Sets and Systems*, 50, 1992, 35-41.
- [17]. Charnes. A. and Klingman, D., The More-for-less paradox in distribution models, *Cahiers du Centre d'Etudes Recherche Operationnelle*, 13, 1971, 11-22.
- [18]. Charnes. A., S. Duffuaa and Ryan, M., The More- for-Less Paradox in Linear Programming, *European Journal of Operation Research*, 31, 1987, 194-197.
- [19]. Charnes, A., Cooper, W.W., The stepping stone method for explaining linear programming calculation in transportation problem, *Mgmt. Sci.*, 1, 1954, 49 – 69.
- [20]. Charnes, A., Cooper, W.W., and Henderson, A., *An Introduction to Linear Programming*, Wiley, New York, 1953.
- [21]. Chandra. S and P.K. Saxena., Time Minimizing Transportation Problem with impurities, *Asia- Pacific J. Op. Res.*, 4, 1987, 19-27.
- [22]. Currin.D.C., Transportation problem with inadmissible routes. *Journal of the Operational Research Society*, 37, 1986, 387-396.
- [23]. Dantzig, G.B., *Linear Programming and Extensions*, Princeton University Press, Princeton, N J , 1963.
- [24]. Das.S.K., Goswami.A and Alam.S.S., Multi-objective transportation problem with interval cost, source and destination parameters, *European Journal of Operational Research*, 117, 1999, 100-112.
- [25]. Garfinkel.R.S and Rao.M.R., The bottleneck transportation problem, *Naval Research Logistics Quarterly*, 18, 1971, 465 – 472.
- [26]. Gaurav Sharma, S. H. Abbas, Vijay kumar Gupta., Solving Transportation Problem with the help of Integer Programming Problem, *IOSR Journal of Engineering*, 2 , 2012, 1274-1277.
- [27]. Gupta, A., Khanna, S., and Puri, M.C., Paradoxical situations in transportation problems, *Cahiers du Centre d'Etudes Recherche Operationnelle*, 34, 1992, 37-49.
- [28]. Hitchcock, F.L., The distribution of a product from several sources to numerous localities. *Journal of Mathematics & Physics*, 20, 1941, 224-230.
- [29]. Ho. H.W. & Wong, S.C. , Two-dimensional continuum modeling approach to transportation problems, *Journal of Transportation Systems Engineering and Information Technology*, 6, 2006, 53-72.
- [30]. Hadley. G., *Linear Programming*, Addition-Wesley Publishing Company, Massachusetts, 1972.
- [31]. Hammer.P.L., Time minimizing transportation problems, *Naval Research Logistics Quarterly*, 16, 1969, 345 –357.
- [32]. Hussien, M. L., Complete solutions of multiple objective transportation problem with possibilistic coefficients, *Fuzzy Sets & Systems*, 93, 1998, 293-299.
- [33]. Ignizio, J.P., *Goal Programming and Extensions*, Lexington Books, Massachusetts, 1976.
- [34]. Ilija Nikolic', Total time minimizing transportation problem, *Yugoslav Journal of Operations Research*, 17, 2007, 125-133.
- [35]. Isermann.H., Bielefeld., Solving the transportation problem with mixed constraints, *Zeitschrift fur Operations Research*, 26, 1982, 251-257.
- [36]. Isermann.H., The enumeration of all efficient solution for a linear multiple-objective transportation problem, *Naval Res Logistics Quarterly*, 26, 1979, 123-139.
- [37]. Issermann.H., Linear bottleneck transportation problem, *Asia Pacific Journal of Operational Research*, 1, 1984, 38 – 52.
- [38]. Jain.M and Saksena.P.K., Time minimizing transportation problem with fractional bottleneck objective function, *Yugoslav J of Operations Research*, 22, 2012, 115-129.
- [39]. Joshi, V. D. and Gupta, N., On a paradox in linear plus fractional transportation problem, *Mathematika*, 26, 2010, 167-178.
- [40]. Kasana, H.S., and Kumar, K.D., *Introductory Operations Research Theory and Applications*, Springer International Edition, New Delhi, 2005.
- [41]. Kavitha. K and Anuradha.D., Heuristic algorithm for finding sensitivity analysis of a more for less solution to transportation problems, *Global Journal of Pure and Applied Mathematics*, 11, 2015, 479-485.

- [42]. Khanna.S, Bakhshi.H.C and Arora.S.R., Time minimizing transportation problem with restricted flow, Cahiers du Centre de Recherche Operationelle, 25, 1983, 65-74.
- [43]. Kirca and Statir., A heuristic for obtaining an initial solution for the transportation problem, Journal of operational Research Society, 41, 1990, 865-867.
- [44]. Klibi.W, F. Lasalle, A. Martel and Ichoua.S., The stochastic multiperiod location transportation problem, Transportation Science, 44, 2010, 221-237.
- [45]. Klein, M., A primal method for minimal cost flows with applications to the assignment and transportation problems, Management Science, 14, 1967, 205-220.
- [46]. Korukoglu.S and Balli.S., An Improved Vogel's Approximation Method for the Transportation Problem, Association for Scientific Research, Mathematical and Computational Application, 16, 2011, 370-381.
- [47]. Koopmans, T.C., (1947), Optimum utilization of the transportation system, in: The Econometric Society Meeting (Washington, D.C., September 6-18, D.H. Leavens, ed.) [proceedings of the International Statistical Conference- Volume V, 1948, 136-146] [reprinted in: Econometrica 17, 1949, 136-146] [reprinted in: Scientific papers of Tjalling C. Koopmans, Springer, Berlin, 1970, 184-193]
- [48]. Koopmans, T.C., and Reiter.S., A model of transportation, in: Activity Analysis of Production and Allocation, Proceedings of a Conf. (Koopmans, ed.), Wiley, New York, 1951, 222-259.
- [49]. Krzysztof Goczyła, Janusz Cielatkowski., Case study Optimal routing in a transportation network, European Journal of Operational Res, 87, 1995, 214-222.
- [50]. Kwak, N.K. and Schniederjans, M.J., A goal programming model for improved transportation problem solutions, Omega, 12, 1979, 367-370.
- [51]. Kwak N.K. and Schniederjans, M.J., Goal programming solutions to transportation problems with variable supply and demand requirements, Socio-Economic Planning Science, 19, 1985, 95-100.
- [52]. Lau, H. C. W., Chan, T. M., Tsui, W. T., Chan, F. T. S., Ho, G. T. S. and Choy, K. L., A fuzzy guided multi-objective evolutionary algorithm model for solving transportation problem, Expert System with Applications: An International Journal, 36, 2009, 8255-8268.
- [53]. Lee, S.M., Goal Programming for Decision Analysis, Auerbach, Philadelphia, 1972.
- [54]. S.M. Lee and L.J., Moore, Optimizing transportation problems with multiple objectives, AIEE Transactions, 5, 1973, 333-338.
- [55]. Leberling, H., On finding compromise solutions for multicriteria problems using the fuzzy min-operator, Fuzzy Sets and Systems, 6, 1981, 105-118.
- [56]. Li, L. and Lai, K. K., A fuzzy approach to the multi-objective transportation problem, Computers and Operational Research, 28, 2000, 43-57.
- [57]. Lohgaonkar, M. H. and Bajaj V. H., Fuzzy approach to solve multi-objective capacitated transportation problem, Int J. of Bioinformatics Res, 2, 2010, 10-14.
- [58]. Madhuri.D., Linear fractional time minimizing transportation problem with impurities, Information Sciences Letters, 1, 2012, 7-19.
- [59]. Mistuo GE, Yinzhen.L and Kenichi ID., Solving Multi-Objective Transportation Problem by Spanning Tree-Based Genetic Algorithm, IEICE Trans. Fundamentals, E82-A, 1999, 2802-2810.
- [60]. Mollah Mesbahuddin Ahmed, Abu Sadat Muhammad Tanvir, Shirin Sultana, Sultan Mahmud and Md. Sharif Uddin., An Effective Modification to Solve Transportation Problems: A Cost minimization Approach, Annals of Pure and Applied Mathematics, 6, 2014, 199-206.
- [61]. Okunbor, D., Management decision-making for transportation problems through goal programming, J of Academy of Business and Econ., 4, 2004, 109-117.
- [62]. Osuji George A., Opara Jude, Nwobi Anderson C., Onyeze Vitus, Iheagwara Andrew I., Paradox Algorithm in Application of a Linear Transportation Problem, American Journal of Applied Mathematics and Statistics, 2, 2014, 10-15.
- [63]. Osuji, George A, Okoli Cecilia N, Opara, Jude, Solution of multi-objective transportation problem via fuzzy programming algorithm, Science Journal of Applied Mathematics and Statistics, 2, 2014, 71-77.

- [64]. Pandian.P and Natarajan.G., A new method for finding an optimal solution for transportation problems, International Journal of Math. Sci. and Engg. Appls.,4,2010, 59 – 65.
- [65]. Pandian, P and Anuradha.D., Path Method for Finding a More-For-Less Optimal Solution to Transportation Problems, International Conference on Mathematical Computer Engineering, 1, 2013, 331–337.
- [66]. Pandian, P., and Natarajan, G., Fourier method for solving transportation problems with mixed constraints, Int. J of Contemp. Math Sciences, 5, 2010a, 1385-1395.
- [67]. Pandian, P., and Natarajan, G., A new method for finding an optimal more-for-less solution of transportation problems with mixed constraints, Int. J. Contemp. Math. Sciences, 5, 2010b, 931-942.
- [68]. Pandian.P and Natarajan.G., A new method for solving bottleneck-cost transportation problems, International Mathematical Forum, 6, 2011, 451 – 460.
- [69]. Pandian.P and D.Anuradha., A new approach for solving bi-objective transportation problems,Australian Journal of Basic and Applied Sciences, 5, 2011, 67-74.
- [70]. Pavel Kolman, Time minimizing transportation problems with partial limitations of transported amount for transport participants, AIP Conf. Proc, 1648, 2015.
- [71]. PeerayuthCharnsethikul and SaereeSvetasreni.,The Constrained Bottleneck Transportation Problem, Journal of Mathematics and Statistics,3, 2007, 24-27.
- [72]. Ping Ji, Chu KF., A dual - Matrix approach to the transportation problem, Asia -Pacific Journal of Operation Research, 19, 2002, 35-45.
- [73]. Putcha. C.S., and Shekaramiz.A., Development of a new method for arriving at initial basic feasible solution for optimization problems in Engineering, 23rd European Conference on Operational Research, Bonn, 2009.
- [74]. RabindraNathMondal, Farhana Rashid, Poly Rani Shaha, Raju Roy., An Innovative Method for Unraveling Transportation Problems with Mixed Constraints, American Journal of Mathematics and Statistics , 5, 2015, 190-195.
- [75]. RadindraNathMondal and Md. Rezwon Hossain.,Solving Transportation Problem with Mixed Constraints, Proceedings of International Conference on Industrial Engineering and Operations Management, 2012, 1927-1932.
- [76]. Ravi Varadarajan, An optimal algorithm for 2 x n bottleneck transportation problems, Operations Research Letters,10, 1991, 525-529.
- [77]. Rayan, M., More-for-less paradox in distribution model, Extremal methods and systems analysis, Springer, New York, 1978.
- [78]. Rekha.S.,B.Srividhya andS.Vidya,Transportation Cost Minimization: Max Min Penalty Approach, IOSR Journal of Mathematics,10, 2014, 06-08.
- [79]. RekhaVivek Joshi, Optimization Techniques for Transportation Problems of Three variables, IOSR Journal of Mathematics, 9, 2013,46-50.
- [80]. Rita Malhotra, On bi-criteria transportation problem, Combinatorial Optimization: Some Aspects ,Narosa Publishing House, New Delhi, India, 2007.
- [81]. Ringuest.J.L.,and D.B. Rinks, Interactive solutions for the linear multiobjective transportation problem, European Journal of Operational Research, 32 , 1987, 96-106.
- [82]. Robb, D. J.,The more- for-less paradox in distribution models: An intuitive explanation, IIE Transactions, 22, 1990, 377–378.
- [83]. Sarbjit Singh, Note on Transportation Problem with New Method for Resolution of Degeneracy, Universal J. of Industrial and Business Management,3, 2015, 26-36.
- [84]. Sayed A. Zaki, Abd Allah A. Mousa, Hamdy M. Geneedi, Adel Y. Elmekawy,Efficient multiobjective genetic algorithm for solving transportation, assignment, and transshipment Problems, Applied Mathematics, 3, 2012, 92-99.
- [85]. Schrijver, A., On the history of the transportation and maximum flow problems, Mathematical Programming, 91,2002, 437-445.
- [86]. Seshan, C.R., and Tikekar, V.G., On Sharma-Swarup algorithm for time minimizing transportation problems, Proc. Indian Acad. Sci., 89, 1980, 101–102.

- [87]. Sharma, Gaurav; Abbas, S. H.; Gupta, Vijay, Optimum Solution of Transportation Problem with the help of phase-II method of Simplex Method, Indian journal of applied life science, 6, 2011, 49-54 .
- [88]. Sharma, Gaurav; Abbas, S. H.; Gupta, Vijay, Dual Simplex Algorithm for Proctor & Gamble to Solve Transportation Problem, Journal of Ultra Scientist of Physical Sciences, 23, 2011.
- [89]. Sharma..R.R.K, andSharma.K.D., A new dual based procedure for the transportation problem, European Journal of Operational Res., 122, 2000, 611-624.
- [90]. Sharif Uddin.M.,Transportation Time Minimization: An Algorithmic Approach, Journal of Physical Sciences, 16, 2012, 59-64.
- [91]. Sharma, J.K. and K. Swarup,Time minimizing transportation problem, Proceeding of Indian Academy of Sciences (Math. Sci.), 86, 1977, 513-518.
- [92]. Sharma, J.K., and K.Swarup, Transportation fractional programming with respect to time, Ticerca Operativa,7, 1978, 49-58.
- [93]. Sonia and M.C.Puri, Two level hierarchical time minimizing transportation problem, TOP,12, 2004, 301-330.
- [94]. Storoy, S, The transportation paradox revisited, N-5020 Bergen, Norway, 2007.
- [95]. Sudhakar VJ, Arunnsankar N, Karpagam T., A new approach for find an Optimal Solution for Trasportation Problems, European Journal of Scientific Research,68, 2012, 254-257.
- [96]. Sultan, A., Heuristic for Finding an Initial B. F. S. in Transportation Problems, Opsearch, 25, 1988, 197-199.
- [97]. Sultan, A. and Goyal, S.K., Resolution of Degeneracy in Transportation Problems, Journal Operational Research Society, 39, 1988,411-413.
- [98]. Surapati, P. and Roy, T. K., Multi-objective transportation model with fuzzyparameters: Priority based fuzzy goal programming approach, Journal ofTransportation Systems Engg.and Information Technology, 8, 2008, 40-48.
- [99]. Sun, M., The transportation problem with exclusionary side constraints and branch-and-bound algorithms, European Journal of Operational Res, 140,2002,629-647.
- [100].Szwarc W.,The transportation paradox, Naval Res. Logistics. Q., 18, 1971, 185-202.
- [101].Szwarc.W., Some remarks on the transportation problem, Naval Research Logistics Quarterly, 18, 1971, 473 –485.
- [102].Taghrid Imam Gaber Elsharawy Mohamed Gomah Iman Samy , Solving Transportation Problem Using Object-Oriented Model, International Journal of Computer Science and Network Security, 9, 2009, 353-361.
- [103].Veena Adlakha, Krzysztof Kowalski,Alternate Solutions Analysis For Transportation problems, Journal of Business & Economics Research,7, 2009.
- [104].Veena Adlakha and K. Kowalski., A Quick Sufficient Solution to the More for Less Paradox in TransportationProblem, Omega, 26, 1998, 541–547.
- [105].Veena Adlakha and K. Kowalski., A Heuristic Method for More-for-Less in Distribution Related Problems,International Journal of Mathematical Education in Science and Technology,32, 2001, 61–71.
- [106].Veena Adlakha, K. Kowalski and B. Lev, Solving Transportation Problem with Mixed Constraints, InternationalJournal of Management Science and Engineering management, 1, 2006, 47–52.
- [107].Veena Adlakha, K. Kowalski, R. R.Vemuganti, and B. Lev, More-for-less algorithm for fixed charge transportation problems, Omega, 35, 2007, 116–127.
- [108].Verma, R., Biswal, M. P. and Verma, A. B., Fuzzy programming technique tosolve multi-objective transportation problems with some non-linear membership functions, Fuzzy Sets and Systems, 91, 1997, 37-43.
- [109].Verma, R., Biswal, M. P., Biswas, A., Fuzzy programming technique to solve multi-objective Transportationproblem with some non-linear membership functions, Fuzzy sets and systems,91, 1997, 37-43.
- [110].Vishwas Deep Joshi and Nilama Gupta, Identifying more-for-less paradox in the linear fractional transportationproblem using objective matrix, Mathematika, 28, 2012, 173–180.
- [111].Waiel F. and Abd El-Wahed,A multi-objective transportation problem under fuzziness, Fuzzy Sets and Systems,117, 2001, 27-33.

- [112].Wahed, W. F. and Sinna, M. A., A hybrid fuzzy-goal programming approach to multiple objective decisionmaking problems, Fuzzy Sets and Sy, 119, 2001, 71-85.
- [113].WuttinanNunkaew and BusabaPhruksaphanrat, A multiobjective programming for transportation problem with the consideration of both depot to customer and customer to customer relationships, International Multi Conference of Engineers and Computer Scientists, 2009.
- [114].Zangiabadi, M. and Maleki, H. R., Fuzzy goal programming for multi-objective transportation problems, Applied Math and Comp, 24, 2007, 449-460.
- [115].Żółkiewski.S., Modelling of dynamical systems in transportation using the modyfit application, Journal of Achievements in Materials and Manufacturing Engineering, 28, 2008, 71-74.
- [116].Zeleny.M., Multiple criteria decision making; Mc Graw-Hill Book Company, 1982.