Plagiarism Checker X Originality Report

Similarity Found: 12%

Date: Thursday, November 22, 2018
Statistics: 554 words Plagiarized / 4681 Total words
Remarks: Low Plagiarism Detected - Your Document needs Optional Improvement.

Abstract—The aim of this study was to develop multi-objective optimization model for wheat flour supply chain. The model was developed by considering raw material substitution with local flour. The local flour such as mocaf, tapioca, sweet potato, modified corn flour etc. can substitute a part or whole of wheat flour for wheat flour-based product application.

However, raw material substitution can impact supply chain network, raw material supply policy, and product quality so that it is important to optimize supply chain for that case. In this work, we used mocaf as flour substitution for wheat flour in wheat flour mill. We developed multi-objective supply chain model that minimized total cost and maximized product quality.

Genetic algorithm approach was used to solve the optimization problem. For numerical experiment, we used supply chain configuration consisting of three wheat suppliers, three mocaf suppliers, three wheat flour mills, four distribution centers, and two food factories. Keywords: multi-objective optimization, supply chain, raw material substitution, genetic algorithm I.

INTRODUCTION ODAY, Indonesia is the second largest wheat importer country after Egypt. Wheat flour consumption in Indonesian continues to increase every year. According data [1] from Indonesian wheat flour producer association (Aptindo) for 2013, Indonesian wheat flour consumption reach as much as 5.43 million metric tons (MT).

The role of wheat flour is important in Indonesia for food resilience, economics and politics so that it is necessary to reduce dependency on wheat (flour). Some efforts have conducted to reduce wheat import in Indonesia such as developing wheat agricultural but it failed. Another effort is conducting wheat substitution with native Indonesian flour such as tapioca, modified cassave flour (mocaf), sweet flour, corn, sago, buckwheat flour, etc. Substituting of a part or whole of wheat flour by local flour can impact toward supply chain policies.

Substitution policy makes company use multi-sources so that impact to supply chain decision. Previous work about substitution was carried by Lu [2] that used multi-source and substitution strategy to reduce impact of supply chain disruption. Because wheat commodity involves global supply chain so that susceptive toward supply disruption.

Raw material substitution in wheat flour production can reduce impact of supply chain disruption. In other hand, substitution need multi-source to supply raw material. Wheat flour substitution also can increase supply chain cost and decrease product quality. Richana [3] state that wheat flour substitution with local flour in certain amount can reduce product quality both taste and nutrition.

Previous studies about product substitution most describe consumer driven substitution (demand substitution). This consumer driven substitution occurs because ordered product by consumer is not available and usually firm offers the other similar product as replacement ordered product. Optimization of production with substitution considering conducted by [4] for multi product and single period.

Production optimization model of a single-period, multiproduct, downward substitution which has one raw material as the production input and produces N different products as outputs [5]. The demands and yields for the products are random. According to Chopra [6], supply chain is a sequence of processes and flows that take place within different supply chain stages and to satisfy a customer need for a product. A supply chain consists of a set of facilities, suppliers, customers, products and method of inventory control, procurement and distribution.

The chain connects suppliers which produce raw material (product) and customers as end product user [7]. There are some decisions in supply chain management that is using to by decision maker. The decision involves: production, inventory, location and facility alternative, transportation and information.

In the real world, supply chain problems often face some objectives to be attained simultaneously which sometime there is conflict occur. In this case, we can see that problems such as in plant location alternative decision which objectives to minimize total cost of supply chain, but in order hand to attain minimum product delivery time to consumer.

To fulfill several objectives in supply chain design by considering raw material substitution in wheat flour supply chain, it needs to be solved by multi-objective optimization. There are many studies about multi-objective optimization of supply chain have conducted before, but there have not been considering raw material substitution as explained earlier.

In [7] designed supply chain network for plastic based Trisna1,2, Marimin2, Yandra Arkeman2, Titi Candra Sunarti 2 1Department of Industrial Engineering, Faculty of Engineering, Malikussaleh University Lhokseumawe, Aceh 2Department of Agro-industrial Technology, Faculty of Agricultural Technology, Bogor Agricul tural University Campus IPB Darmaga, Bogor 16002, Indonesia Email: ina0810@gmail.com Genetic Algorithm Based Multi-objective Optimization of Wheat Flour Supply Chain Considering Raw Material Substitution T IÿCÿACÿSÿIÿSÿ2ÿ0ÿ1ÿ5 7ÿ9ÿ9ÿ7ÿ8ÿ-ÿ1ÿ-ÿ5ÿ0ÿ9ÿ0ÿ-ÿ0ÿ3ÿ6ÿ3ÿ-ÿ1ÿ/ÿ1ÿ5ÿ/ÿ$ÿ3ÿ1ÿ.ÿ0ÿ0 c_ 2ÿ0ÿ1ÿ5ÿIÿEÿEÿE product that aims to minimize total cost, maximize costumer service, and minimize capacity utilization ratio. Azaron et al.

[8] developed supply chain design considering uncertainty condition with multi-objective stochastic programming approach. Optimization green supply chain conducted by [9], [10] that aimed to minimize total cost and gas emission. Moncayo–Martínez dan Zhang [11] carried out optimization of each echelon of supply chain with objectives to minimize total cost and lead time.

Many studies about multi-objective optimization for supply chain had been conducted before, but no study considered raw material substitution. That motivates us to perform multi- objective optimization for supply chain considering raw material substitution. In this study, multi-objective optimization aims to obtain optimal supply chain design that fulfill two objectives, i.e.

minimize total cost and maximize product quality. II. LITERATURE REVIEW A. Multi-objective Optimization Multi-objective optimization (MOO) is optimization problem that has objective function more than one. Those objectives attained simultaneously which between those objectives sometimes there is conflict occur.

In general, multi- objective optimization problems can be formulated as follow: Minimize/maximize T k21](x)F (x),...,F ,(x)[FF(x) _ Subject to gj (x) = 0, j= 1, 2, . . . , m , (1) hl (x) = 0, l= 1, 2, . . . , e , where k is objective function number, m is inequality constraint number, and e is equality constraint number.

x ? En is decision variable vector, which n is independent variable (xi) number xi. According to Konak et al. [12], there are two general approaches for solving MOO problems. The first approach is to combine all objective functions to form a single function or move all of the objective functions but one objective move to constrain sets.

There are several methods for this approach that we can see in literatures, such as the weighted-sum method [13], [14] , the e-constraint method [15], [14], lexicographic [14], LP- metrics method [16], goal-programming method [17], etc. The second approach is to determine all Pareto-optimal set as solution not dominated by the others. In MOO problem, a decision maker face to Pareto-optimal solutions that constitute set of trade-offs between different objectives [12].

In mathematic, a feasible solution x 1 in MOO called 'dominate' fi(x1) = fi(x2), i = 1, 2,..., N and f j(x1) < f j(x2) for at least one objective function. A solution non-dominated by other solution called Pareto-optimal. Non-dominated solution is if there are no solution that increases performance measure simultaneously without causes to decrease performance at least one the other objectives [18]. Set of all non-dominated solutions called set with Pareto-optimal and objective value relating for set. B.

Supply Chain Management Supply chain constitutes a facility and alternative distribution network that conducts function of material prosurement, transform raw material to intermedite or final product, and distribute the product to costumers [19]. Supply chain management manages material and information flows between those fasilities i.e. supplier, plant, warehouse, and distributor [20].

In supply chain manegement, there are several decisions that usually be taken by company. The decisions involve i.e. 1) production, 2) inventory, 3) location selection for facilities, 4) transportation, and 5) information. There are many supply chain problems solved by multi- objective optimization approach that had been conducted by researchers.

In [21], [22] developed multi-objective model for supplier selection to fulfill multicriteria. Research developed Multi-objective model for supply chain in various configuration and design. Sarrafha et al. [23] developed multi-objective model for desiging supply chain with multi period involves supplier, plants, DCs, and retailer.

In [24] developed supply chain network with multi period, multi product and multi channel network. In [7], [25] developed supply chain network involving multiple suppliers, plants, and distribution centers (DCs). III. PROBLEM STATEMENT Generally, large modern as well as small and medium food Industries in Indonesia base on wheat flour such as instant noodle, biscuit, cookies, bread, etc.

In order to reduce the use of wheat flour in food industry, until now have been conducted many researches about local flour (native Indonesian flour) that can substitute wheat flour. Until now, several local flour have been developed to substitute a part or whole wheat flour such as mocaf, tapioca, sweet potato, modified corn flour, etc.

If wheat flour substituted with local flour then can reduce wheat flour usage in food industries. Furthermore, that can reduce the impact of disruption caused by disruption supply from importer countries. To s upport government's program on Na tional food security, it is necessary to reduce wheat import.

Food factories are driven to substitute a part of wheat flour with local flour. In this study, substitution carried out in wheat flour plant a maximum 15% of the use of wheat flour. This study discusses wheat flour supply chain considering raw material substitution. Local flour used to substitute wheat flour is mocaf (modified cassava flour).

Generally, mocaf plant produced in small capacity plant so that needed some mocaf supplier to fulfill wheat flour plant requirement. This substitution affects the wheat flour supply chain due to the addition of mocaf supplier. Furthermore, raw material substitution also impacts toward inventory policy, product quality, and reliability supply chain.

New wheat flour supply chain network considers local flour substitution can be showed at Figure 1. IÿCÿACÿSÿIÿSÿ2ÿ0ÿ1ÿ5 8ÿ0ÿ9ÿ7ÿ8ÿ-ÿ1ÿ-ÿ5ÿ0ÿ9ÿ0ÿ-ÿ0ÿ3ÿ6ÿ3ÿ-ÿ1ÿ/ÿ1ÿ5ÿ/ÿ$ÿ3ÿ1ÿ.ÿ0ÿ0 c_ 2ÿ0ÿ1ÿ5ÿIÿEÿEÿE Production Product packing i j l l m m n n n m Raw material storage Wheat four Plant (k) Food industry DCs Stage-1 Stage-2 Stage-3 Costumer zones Supplier Fig. 1. Wheat flour supply chain considering local flour substitution Wheat flour mill orders raw material from Australia, Canada and India.

Plant capacity is 2200 metric ton per day (MT/day). Raw material of wheat stored in storage tank before be milled to become wheat flour. In production process, wheat flour mixed with mocaf to get compound flour. There are three mocaf supplier sources. Wheat flour as final product is stored in storage tank before being packed and then distributed to the food factories and distribution centers.

In this case, we optimized supply chain network involving optimal amount of wheat and mocaf shipped from supplier to flour mill and optimal amount of wheat flour shipped from flour mill to DCs and food factories as well as maximum percentage of mocaf to be mixed. I. MODEL FORMULATION OF MULTI-OBJECTIVE OPTIMIZATION Formulation of mathematical model of multi-objective optimization for this supply chain is assigned to fulfill two objectives. The objectives for this study are to minimize total cost supply chain and maximize product quality.

Supply chain optimization aims to determine amount of raw material that sent from supplier to the wheat flour plant and amount of product that alocated to distributors and food industries. Futhermore, mathematical model formulated to determine a maximum persentage of mocat mixed with wheat flour to fulfill all constraints. A. Assumptions Some assumptions needed in this study to simplify formulating mathematic model, i.e.: 1.

Wheat flour substitution with local flour conducted in wheat flour mill. 2. Local flour is substituted maximum to a maximum of 15%. 3. Local flour used to substitute wheat flour is mocaf. 4. Investation cost to install the additional machines or fasilities be ignored. 5. Using single-product and single-period planning horizon for supply chain configuration in numerical experiment. 6.

The raw material price used is the prevailing price when this study was running. 7. The import price of raw material includes landing charge, customs duty, clearing charges and special additional duty. B. Notations, Variables and Parameters of Model The following notations are used for the mathematical formulation for optimization multi-objective model.

Sets and indices: i = Index of wheat supplier (i ? I) j = Index of mocaf supplier mocaf (j ? J) k = Index of wheat flour mills (k ? K) l = Index of food factory (l ? L) m = Index of distibutors (m ? M) n = Index of customer’s zone (n ? N) Decision variables: Gikt = Amount of wheat transported from supplier i to wheat flour mill k at period t Mjkt = Amount of mocaf transported from supplier j to wheat flour mill n at period t Mp = Persentage of mocaf used to substitute wheat flour Qklt = Amount of product transported from wheat flour mill k to food factory l at period t Dkmt = Amount of product transported from wheat flour mill n to DC m at period t Model parameters: CPkt = Capacity of wheat flour mill n at period t CGit = Capacity of wheat supplier i at period t CMjt = Capacity of mocaf supplier j at period t OGik = Ordering cost of wheat from supplier i to wheat flour mill k OMjk = Ordering cost of mocaf from supplier j to wheat flour mill k PGi = Wheat price from supplier i PMj = Mocaf price from supplier j DFklt = Amount of product sent from wheat flour mill k to food factory l at period t DTkmt = Amount of wheat flour sent from flour mill k to DCs m at period t Dklt = Demand from food factory l to wheat flour mill k at period t Ult = Amount of wheat flour usage in food factory l at period t DCkmt = Demand from DCs m to wheat flour mill k at period t TPklt

= Transportation unit cost from flour mill k to food factory l at period t TDkmt = Transportation unit cost from flour mill k to DCs m at period t TPrkt = Total resulted product at flour mill k at period t R = Utility of raw material of wheat per unit product Hwkt = Holding cost of wheat in wheat flour mill k at period t Hmkt = Holding cost of mocaf in wheat flour IÿCÿACÿSÿIÿSÿ2ÿ0ÿ1ÿ5 8ÿ1ÿ9ÿ7ÿ8ÿ-ÿ1ÿ-ÿ5ÿ0ÿ9ÿ0ÿ-ÿ0ÿ3ÿ6ÿ3ÿ-ÿ1ÿ/ÿ1ÿ5ÿ/ÿ$ÿ3ÿ1ÿ.ÿ0ÿ0 c_2ÿ0ÿ1ÿ5ÿIÿEÿEÿE mill k at period t Hpkt = Holding cost of wheat flour in wheat flour mill k at period t Hplt = Holding cost of wheat flour in food factory l at period t Hpmt = Holding cost of wheat flour at DCs m at period t HGi = Wheat price at supplier i HMj = Mocaf price at supplier j a, b, = Regression coefficient (relation of percentage of mocaf that substituted to wheat flour) C.

Objective functions There were two objectives to be optimized in this supply chain optimization, i.e. to minimize total cost and maximize product quality. Objective 1: Minimization of supply chain total cost. Total cost of supply chain involves raw material purchasing cost (PC), transportation cost (TrC), and holding cost (HC) or be written as follows: Min f1= PC + TrC + HC (2) Involved cost in supply chain can be described as follows: Purchasing cost (PC) Raw material purchasing cost determined by multifying of the price by the amount raw material purchased.

Purchasing cost can be formulated as follows: ______ _ j kt jjkt ikt iikt HMMHGG (3) Transportation cost (TrC) Transportation cost is amount of unit product multify by transportation cost per unit product. Transportation cost consist of transportation from flour mill to DCs and food factory that can be formulated as follows: _ÿ_ÿ_ÿ_ÿ_ÿ__ k lt kmt kmtkmtkltklt TDDTTPDF (4) Holding cost (HC) Holding cost defined as money spent to keep and maintain a stock of raw material or goods in storage.

Total holding cost in supply chain (HC)= holding cost at flour mill k (HC k)+ holding cost at food factory l (HC l)+ holding cost at DCs m (HCm). Holding cost can be determined by multiplying amount of inventory of raw material or product with holding cost per unit per period. Amount of inventory at plant or DCs formulated by amount of product received then reduced by those usage at period t.

In this study, amount of wheat usage at period t assumed with plant capacity (CP kt). Amount of mocaf usage is percentage of maximum mocaf mixed to wheat flour. In wheat flour mill, holding cost involves raw material and product holding cost. Mathematical formulation of raw material holding cost in wheat flour mill (HrC) can be writen as follows: ____ ___ __ ___ ___ kt kt j kt jkt t kt kt kt ikt ikt t kt)CP.MpM(Hm)CPG(Hw (5) Holding cost occured in wheat flour mill because amount product produced more than sent product at period t.

Wheat flour produced at flour mill as much as 75% of raw material. Local flour mixed to wheat flour maximum of 15%, so that result product total can be formulated, as follows: TPrkt= _CPkt +ß(a/(1-ß) CPkt) (6) Where, _ = convertion coeficient of raw material to product ß = Percentage of local flour mixed to wheat flour TPrkt = 0.75CPkt + 0.15(0.75/0.85CP kt) TPrkt =0.88 CPkt (7) Mathematical formulation for holding cost of product at wheat flour mill (HC k) can be written as follows: _ÿ_ÿ_ÿ_ÿ_ÿ_ÿ__ k t k t klt kltktkt DF(TPr(Hp ____ k mt kmt DT)) (8) Mathematical formulation for holding cost of product at food factories (HCl) can be written as follows: _ÿ_ÿ_ÿ_ÿ_ÿ_ÿ__ l t klt lt ltkltlt)UDF(Hp (9) Mathematical formulation for holding cost of product at DCs (HCm) can be written, as follows: _ÿ_ÿ_ÿ_ÿ_ÿ_ÿ_ÿ__ m t kmt mn t mn tkmtmt)UDDT((Hp (10) Total holding cost in supply chain refers to (5) to (10), can be written as follows: HC= HrC + HC k + HCl+ HCm (11) Objective 2: maximize product quality A part substitution of wheat flour by local flour can impact product quality i.e. taste, swelling power, product appeal.

In this study, product quality determined by organoleptic test that uses man sense to quantify texture, apparent, taste, attraction of food product. The organoleptic test in this study used panelists perception about food product test that using substitution flour. Product quality equation based on regression relation of percentage of used substitution flour on product quality.

Mathematical formulation can be written as follows: Max f2 = a + b.Mp (12) To simplify model, Mp can be descibed as amount of mocaf transported from supplier j to wheat flour mill n at period t (?Mjkt) devided by amount of wheat transported from supplier i to wheat flour mill k at period t (?Gikt) or written as Mp= ?Mjkt/?Gikt. D. Model Constraint The constraints were used in this study i.e.:

- Constraint of production capacity of wheat flour mill. _ÿ_ÿ_ÿ_ ___ i t jt kjktikt k ,CPMRGR (13) IÿCÿACÿSÿIÿSÿ2ÿ0ÿ1ÿ5 8ÿ2ÿ9ÿ7ÿ8ÿ-ÿ1ÿ-ÿ5ÿ0ÿ9ÿ0ÿ-ÿ0ÿ3ÿ6ÿ3ÿ-ÿ1ÿ/ÿ1ÿ5ÿ/ÿ$ÿ3ÿ1ÿ.ÿ0ÿ0 c_ 2ÿ0ÿ1ÿ5ÿIÿEÿEÿE - Constraint of wheat supplier capacity (wheat total demand of wheat flour mill is not exceed capacity of supplier i) - __ __ kt iikt i ,CGG (14) - Constraint of mocaf supplier capacity (mocaf total demand of wheat flour mill is not exceed capacity of supplier j) __ __ kt jjkt j ,CMM (15) - Constraint of maximum percentage of usage substitution flour. Mp = 0.15 (16) - Amount of raw material received by wheat flour mill must be larger than demand of food factory and DCs.

__ _ _ÿ_ÿ_ÿ_ÿ_ _ __ mt kmt i t j lt klt t jktikt k ,Dc DMG (17) - Constraint of decision variable: Gint = 0, i_ ÿ,ÿ M jnÿt = 0, j_ , Qnlt = 0, n_ ÿ,ÿ ÿD nÿmt , n_

Muÿlÿtÿiÿ-oÿbÿjÿeÿcÿtÿiÿveÿ ÿoÿpÿtÿiÿmÿiÿzaÿtÿiÿoÿnÿ ÿmÿoÿdÿeÿlÿ ÿ ÿaÿbÿoÿveÿ ÿwÿaÿsÿ ÿsÿoÿlÿvedÿ uÿsÿiÿnÿg ÿgenÿetÿiÿcÿ ÿaÿlÿgoÿrÿiÿtÿhÿmÿ ÿ(ÿGA)ÿ ÿaÿpÿpÿrÿoÿaÿcÿhÿ ÿwÿhÿiÿchÿ ÿsÿhÿoÿwÿeÿdÿ ÿiÿnÿ ÿtÿhÿeÿ nÿeÿxÿtÿ ÿsecÿtÿiÿoÿnÿ.ÿ ÿ ÿ I. RESULTS AND DISCUSSION For numeric experiment, we used supply chain configuration i.e.

3 wheat suppliers, 3 mocaf suppliers, 3 wheat flour mills, 4 DCs, and 2 food factories. Solving multi-objective problem in this study, we used multi-objective software to get Pareto front set. This multi- objective software uses a variant of NSGA II [18] or called by modified NSGA II for solving multi-objective problems.

Generally, procedure of modified NSGA II describe as follows [26]: 1. Initialize population Population is initialized based on the problem range i.e number of decision variables, number of objective functions and constraints if any. A chromosome represents all needed variables including units transported from supplier to flour mill and unit units transported from plant to DCs and food factory.

Each gene represents a single variable (decision variable) as a real number. In this study, number of variables are 36. 2. Sort non-dominated The initialized population is sorted based on non- domination. An individual dominate another if its objective functions is no worse than the other and at least in one of its objective functions is better than the other.

The non-dominated identified to classify fronts F 1, F2,..,FR in Rt. The first front (F1) is a non-dominant set for current population and the second front (F2) is dominated by the individuals in the first front only and goes so on for the next front. 3. Generate offspring population Offspring generated by genetic operator i.e. crossover and mutation that performed on entire population.

In this study crossover function use two- point with rate 0.8 and mutation function use uniform with rate = 0.01. The other parameter settings were performed in this experiment, as follows: Population type = double vector Population size = 200 Selection function = tournament, size= 2 Generation size = 3600 The results are presented for generation sizes of 3600.

The result of trade off between objective function 1 and 2 are presented as Pareto front set as showed at Fig. 2. We can indicate from Fig. 2 that minimum supply chain total cost is $778664.05 and maximum product quality is 4.48 or called Pareto front optimum. Decision maker can design optimum supply chain that can fulfill two-determined objectives bases on Pareto front optimum.

Chromosome length in this model is as many as decision variable i.e. 36 gens. In this case, it makes execution time need longer time. Therefore, for furthermore experiment, we recommend to use efficient representation for transportation/distribution problems such as which developed by [27] that used priority-based encoding in GA.

In search of the optimal solutions, we recommend to perform the experiments under varying sizes of population and the number of generations as well as varying genetic operator setting. For uncertainty environment condition, we recommend to integrate fuzzy logic and multi-objective optimization such as framework developed by Yandra [28].

More over non- numeric method may be considered in selecting the significant factors being investigated [29]. Fig. 2. Pareto front set between objective 1 and objective 2 for population size=200 and generation=3600 II. CONCLUSION This paper presented multi-objective model for supply chain optimization considering raw material substitution. Two objectives were considered i.e.

total cost minimization and product quality maximization. Genetic algorithm approach was used to get Pareto front set in multi-objective for supply chain problem. Pareto front set can be used by the decision maker to design the optimal supply chain considering raw material substitution by many solution alternatives. IÿCÿACÿSÿIÿSÿ2ÿ0ÿ1ÿ5 8ÿ3ÿ9ÿ7ÿ8ÿ-ÿ1ÿ-ÿ5ÿ0ÿ9ÿ0ÿ-ÿ0ÿ3ÿ6ÿ3ÿ-ÿ1ÿ/ÿ1ÿ5ÿ/ÿ$ÿ3ÿ1ÿ.ÿ0ÿ0 c_ 2ÿ0ÿ1ÿ5ÿIÿEÿEÿE REFERENCES [1] Aptindo, “An overview of the indonesian wheat flour industry,” 2013. [Online]. Available: www.aptindo.or.id. [Accessed: 30-Jan-2015].

[2] M. Lu, S. Huang, and Z.-J. Max Shen, “Product substitution and dual sourcing under random supply failures,” Transp. Res. Part B, vol. 45, no. 8, pp. 1251–1265, 2011. [3] N. Richana, “Tepung jagung termodifikasi sebagai pengganti terigu,” War. Penelit. dan Pengemb. Pertan. 32, vol. 32, no. 6, 2010. [4] Y. Bassok, R. Anupindi, and R. Akella, “Single-period multiproduct inventory models with substitution. Operat Res. 47(4): 632-642.,” Oper. Res., vol. 47, no. 4, pp.

632–642, 1999. [5] A. Hsu and Y. Bassok, “Random yield and random demand in a production system with downward substitution,” Oper. Res., vol. 47, no. 2, pp. 277– 290, 1999. [6] S. Chopra and P. Meindl, Supply Chain Management: Strategy, Planning, and Operations, Second. New Jersey: Prentice Hall Inc, 2004. [7] F. Altiparmak, M. Gen, L. Lin, and T. Paksoy, “A genetic algorithm approach for multi-objective optimization of supply chain networks,” Comput. Ind. Eng., vol.

51, no. 1, pp. 196–215, 2006. [8] A. Azaron, K. N. Brown, S. A. Tarim, and M. Modarres, "A multi- objective stochastic programming approach for supply chain design considering risk," Int. J. Prod. Econ., vol. 116, pp. 129–138, 2008. [9] F. Wang, X. Lai, and N. Shi, "A multi-objective optimization for green supply chain network design," Decis. Support Syst., vol. 51, no. 2, pp. 262– 269, 2011.

[10] T. Paksoy, N. Y. Pehlivan, and E. Özceylan, "Fuzzy Multi-Objective Optimization of a Green Supply Chain Network with Risk Management that Includes Environmental Hazards," Hum. Ecol. Risk Assess., vol. 18, no. 5, pp. 1120–1151, 2012. [11] L. A. Moncayo-Martínez and D. Z.

Zhang, "A Multi-objective Optimization for Supply Chain Network using Intelligent Water Drop," in IIE Annual Conference. Proceedings, 2014, p. 3191. [12] S. Prasannavenkatesan and S. Kumanan, "Multi-objective supply chain sourcing strategy design under risk using PSO and simulation," Intell. J. Adv. Manuf. Technol., vol. 61, pp. 325–337, 2012. [13] A. Azapagic and R. Clift, "The application of life cycle assessment to process optimisation," Comput. Chem. Eng., vol. 23, no.

10, pp. 1509– 1526, 1999. [14] S. Liu and L. G. Papageorgiou, "Multiobjective optimisation of production, distribution and capacity planning of global supply chains in the process industry," Omega, vol. 41, pp. 369–382, Apr. 2013. [15] F. You, L. Tao, D. J. Graziano, and S. W.

Snyder, "Optimal Design of Sustainable Cellulosic Biofuel Supply Chains?: Multiobjective Optimization Coupled with Life Cycle Assessment and Input – Output Analysis," AIChE J., vol. 58, no. 4, pp. 1157–1180, 2012. [16] S. M. J. M. Al-e-hashem, H. Malekly, and M. B. Aryanezhad, "A multi- objective robust optimization model for multi-product multi-site aggregate production planning in a supply chain under uncertainty," Intern.

J. Prod. Econ., vol. 134, no. 1, pp. 28–42, 2011. [17] Z. Zhou, S. Cheng, and B. Hua, "Supply chain optimization of continuous process industries with sustainability considerations," Comput. Chem. Eng., vol. 24, no. 2–7, pp. 1151–1158, Jul. 2000. [18] K. Deb, Multi-objective Optimization Using Evolutionary. New York: John Wiley & Sons., 2001. [19] R. Ganeshan and T. P.

Harrison, "introduction to supply chain management," Penn State University, 1995. [20] D. J. Thomas and P. M. Griffin, "Coordinated supply chain management. European Journal of Operational Research, 94, 1–15," Eur. J. Oper. Res., vol. 94, pp. 1–15, 1996. [21] Z. Liao and J. Rittscher, "A multi-objective supplier selection model under stochastic demand conditions," Intern. J. Prod. Econ., vol. 105, pp. 2006– 2008, 2007. [22] W.-C.

Yeh and M.-C. Chuang, “Using multi-objective genetic algorithm for partner selection in green supply chain problems,” Expert Syst. Appl., vol. 38, no. 4, pp. 4244–4253, Apr. 2011. [23] K. Sarrafha, S. H. Rahmati, S. T. A. Niaki, and A. Zaretalab, “A bi- objective integrated procurement, production, and distribution problem of a multi-echelon supply chain network design: A new tuned MOEA,” Comput.

Oper. Res., vol. 54, pp. 35–51, Feb. 2015. [24] R. Z. Farahani and M. Elahipanah, “A genetic algorithm to optimize the total cost and service level for just-in-time distribution in a supply chain,” Int. J. Prod. Econ., 2008. [25] S. Validi, A. Bhattacharya, and P. J. Byrne, “A case analysis of a sustainable food supply chain distribution system — A multi-objective approach,” Intern. J. Prod.

Econ., pp. 1–17, 2014. [26] S. Bandyopadhyay and R. Bhattacharya, “Solving a tri-objective supply chain problem with modified NSGA-II algorithm,” J. Manuf. Syst., vol. 33, pp. 41–50, Jan. 2014. [27] M. Gen, R. Cheng, and L. Lin, Network Models and Optimization: Multiobjective Genetic Algorithm Approach. London: British Library Cataloguing in Publication Data, 2008. [28]Yandra, Marimin, J. Irawadi, Eriyatno, and H.

Tamura, “An Integration of Multi-Objective Genetic Algorithm and Fuzzy Logic For Optimization Of Agroindustrial Supply Chain Design,” in Proceeding of the 51st International Society for the System Science Conference, 2007. [29] Marimin, M. Umano, I. Hatono, and H. Tamura, “Non-numeric method for pairwise fuzzy group decision analysis”, J. Intell. Fuzzy Syst., vol.5, no. 3, pp. 257-269, 1997. IÿCÿACÿSÿIÿSÿ2ÿ0ÿ1ÿ5 8ÿ4ÿ9ÿ7ÿ8ÿ-ÿ1ÿ-ÿ5ÿ0ÿ9ÿ0ÿ-ÿ0ÿ3ÿ6ÿ3ÿ-ÿ1ÿ/ÿ1ÿ5ÿ/ÿ$ÿ3ÿ1ÿ.ÿ0ÿ0 c_ 2ÿ0ÿ1ÿ5ÿIÿEÿEÿE

INTERNET SOURCES:

3% - http://ieeexplore.ieee.org/document/7415158/
<1% - http://independent.academia.edu/YandraArkeman
<1% - https://pubsonline.informs.org/doi/10.1287/opre.47.2.277
<1% - https://www.slideshare.net/ialwaysthinkprettythings/scm-module-1
1% - http://www.growingscience.com/dsl/Vol5/dsl_2015_45.pdf
<1% - http://scientiairanica.sharif.edu/article_3455_b208595f235e385785e43009c4a46f29.pdf
1% - http://iosrjen.org/Papers/vol4_issue3%20(part-2)/D04321923.pdf
<1% - https://www.scribd.com/document/166654374/Shape-optimization-of-two-dimensional-cavitators-in-supercavitating-flows-using-NSGA-II-algorithm
<1% -

https://www.researchgate.net/publication/258520322_Non-Numeric_Method_for_Pairwise_Fuzzy_Group-Decision_Analysis
<1% - https://link.springer.com/article/10.1007/s12351-016-0268-3
<1% - https://www.sciencedirect.com/science/article/pii/S0925527317304267
<1% -
https://www.researchgate.net/publication/309419356_Optimal_Route_Selection_in_Complex_Multi-stage_Supply_Chain_Networks_using_SARSAl
<1% - https://pubs.acs.org/doi/abs/10.1021/ie0100030
<1% - https://www.tandfonline.com/doi/full/10.1057/jors.2010.149
<1% -
https://www.researchgate.net/publication/259810164_A_Multi-Objective_Optimization_using_Genetic_Algorithm_for_Green_Supply_Chain_Management
<1% -
http://paperity.org/p/78309239/multi-criteria-decision-making-approaches-for-green-supply-chains-a-review
<1% - http://emps.exeter.ac.uk/engineering/staff/dzzhang/publications/
<1% - https://dl.acm.org/citation.cfm?id=2787027
<1% - https://www.hindawi.com/journals/mpe/2017/3460721/
<1% -
https://www.deepdyve.com/lp/wiley/optimal-design-of-sustainable-cellulosic-biofuel-supply-chains-uMbDkdnSGO
<1% -
https://prezi.com/-foayymenlrz/macro-production-planning-at-dalgakran-compressor/
<1% - https://link.springer.com/article/10.1007%2Fs10696-016-9263-5
<1% - https://www.scribd.com/document/235430142/risk-management
<1% - https://link.springer.com/article/10.1007%2Fs00521-017-2925-8
<1% - https://www.sciencedirect.com/science/article/pii/S2405896315005406
<1% -
http://www.academia.edu/11637505/A_robust_optimization_model_for_a_supply_chain_under_uncertainty
<1% - http://www.tandfonline.com/doi/full/10.1080/00207543.2015.1035811
<1% - https://www.sciencedirect.com/science/article/pii/S0925527317302542
<1% -
https://www.scribd.com/document/272726401/Container-Deport-Integrated-to-Logistic-Network
<1% - http://business.expertjournals.com/23446781-512/