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2	13 Agustus 2020	Review tahap 1
3	28 Desember 2020	Review tahap 2
4	12 Januari 2021	Publish

Pengiriman Makalah

UNIVERSITAS KRISTEN PETRA

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Yujor paper submission

1 message

I Gede Agus Widyadana <gede@petra.ac.id> Mon, May 11, 2020 at 11:02 PM
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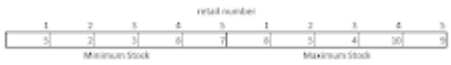
8 attachments



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Retail Number

period	1	2	3	4	5
1	0	1	0	3	2
2	1	0	2	3	0
3	2	0	0	1	3
4	0	0	1	2	3
5	4	2	5	3	1

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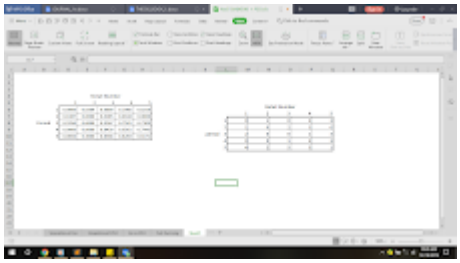

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	Optimal Cost		Running Time (s)	
Simulation	GA	PSO	GA	PSO
Case 1	45123	44296,6	3311	2850
Case 2	41297,2	41058,6	3281	2659
Case 3	32568	32164,4	3587	3226

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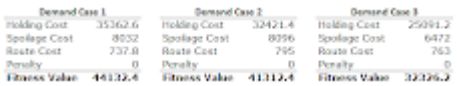

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An inventory routing problem for deteriorating items with dynamic demand and spoilage rate

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Abstract

Inventory routing problems are one of an important tool to be used for implementing vendor manage inventory where a vendor sets their delivery route and quantity of their products at each retailer to minimize transportation and inventory cost. Many researchers try to develop methods for solving inventory routing problem, however, only a few of them develop methods for inventory routing problems for deteriorating items. In this paper, we develop a model and methods to solve the inventory routing problem for deteriorating items with dynamic demand and spoilage rates. We develop a Genetic Algorithm and Particle Swarm Optimization to solve the problem with various demands in a specific planning period. A sensitivity analysis is conducted to verify the model and to get management insight into the model. The result is interesting where dynamic demands result in higher inventory cost than static demands and increasing demand result in increasing inventory cost. Increasing demand and deteriorating rates significantly affect the total cost.

Keywords: Inventory, spoilage, dynamic demand, Genetic Algorithm, Particle Swarm Optimization

INTRODUCTION

Inventory Routing Problem deals with inventory and distribution issues since both costs are dominant cost in the supply chain ([4] and [12]), therefore many organizations try to streamline stock holding and transportation expenses. The IRP is an optimization inventory problem for some stores by considering transportation costs. The goal of IRP is transportation and inventory minimization [16]. For more than 30 years, many researchers have given attention to the IRP and there are many variations of models and solutions that have been studied [3]. The IRP model includes IRP with the continuous move was introduced by [14]. Aghezzaf and Landeghem [1] developed IRP with multi-tours, and then stochastic demand IRP was introduced by [6] and Liu et.al. [9] developed an IRP model with time windows.

Recently many IRP models consider perishable items since perishable items are relevant for some important commodities such as fruits, vegetables, and meats. Perishable items have a random lifetime regarding environmental conditions such as temperature and humidity, the uncertainty of transportation time, and harvest time [8]. Azadeh et. al. [1] developed an IRP problem with perishable items and single vendor. The items can be sent from one store to the

other store, and the used Genetic Algorithm and the Taguchi Method to solve the problem. A similar model for perishable items was developed by [5], however, they did not consider transshipment between stores. They used Genetic Algorithm to solve the model. Hu et.al. [7] developed a simple IRP for perishable items and they developed decomposition and local search methods as efficient methods for solving the problem. Widyadana and Irohara [15] developed an IRP model by considering perishable items and time windows. In the model, items are not only deteriorated during storing period in warehouses but the items are also deteriorating during the transportation period. An IRP problem with deteriorating items was also developed by [11]. Instead, only use one objective, they considered multi-objective by regarding environmental issues in their model.

In this model, we developed an IRP problem based on [2] and introduce dynamic demand instead of static demand since dynamic demand is more realistic. Since the problem is an NP-hard problem, Genetic algorithm and Particle Swarm Optimization are used to solve the problem. The Genetic Algorithm is one effective method to be used for solving IRP problems [2] and [5]. The other effective metaheuristic method that is used to solve NP-hard problems such as IRP problem is Particle Swarm Optimization [14] and [10].

MODEL DEVELOPMENT

We developed the Inventory routing model in this paper using on [2] with dynamic demand and spoilage rate. Some assumptions that are used in this model are:

- Demand rate distribution during the replenishment period (T) is known.
- Deteriorating rate during replenishment period (T) is known

In this model we assume there is one product, one vendor and one delivery player with multi-period. Notations that are used in this paper are:

Parameters:

h_i	: Inventory cost at store $-i$
T	: Replenishment period
M	: Numbers of store
$d_i\,(t)$	: Delivery volume from store i at period t
$Sr_i\,(t)$	: Deteriorating rate in store i at period t
$Sp_i\,(t)$	: Number of reject in store i at period t
Q	: Delivery capacity
c_{ij}	: Delivery cost from store I to store j
C_i	: warehouse capacity at store i
Pr	: Product price
$I_i\,(0)$	: Initial stock in store i

Variables

L_i : Minimum stock in store i

H_i : Maximum stock in store i

$X_{ij}(t)$: $\begin{cases} 1, \text{ if product delivered from store } i \text{ to store } j \\ 0, \text{ otherwise} \end{cases}$

$q_i(t)$: Product quantity delivered to store i at period t

$$MinZ = \sum_{t=1}^{T}\sum_{i=1}^{M} h_i I_i(t) + Pr\sum_{t=1}^{T}\sum_{i=1}^{M} Sp_i(t) + \sum_{t=1}^{T}\sum_{i=1}^{M}\sum_{j=i+1}^{M} c_{ij}X_{ij}(t) \quad (1)$$

Constraints:

$$I_i(t) = I_i(t-1) - Sp_i(t-1) + q_i(t) - d_i(t) \quad i = 1..M; t = 1..T \quad (2)$$

$$Sp_i(t) = Sr_i(t)\, I_i(t) \quad i = 1..M; t = 1..T \quad (3)$$

$$I_i(t) \leq C_i \quad i = 1..M; t = 1..T \quad (4)$$

$$I_i(t) \geq L_i \quad i = 1..M; t = 1..T \quad (5)$$

$$\sum_{i=1}^{M} q_i(t) \leq Q \quad t = 1..T \quad (6)$$

$$\sum_{i=0}^{M} X_{ij}(t) = \sum_{i=0}^{M} X_{ji}(t) \quad j = 1..M; t = 1..T \quad (7)$$

$$X_{ij}(t) \in \{0, 1 \qquad i = 1..M; j = 1..M; i \neq j; t = 1..T \quad (9)$$

$$Sr_i(t) \in \{0\%, \ldots, 100\% \qquad i = 1..M; t = 1..T \quad (10)$$

$$T, M \in \{0, 1, 2, 3, \ldots \quad (11)$$

$$h_i, d_i(t), Q, C_i, I_i(t), L_i, M_i, q_i(t) \geq 0 \quad (12)$$

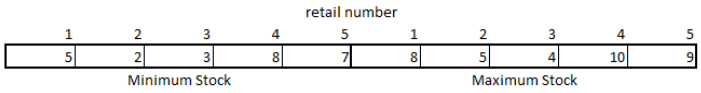
The objective function is shown in Eq. 1, where the total cost consist of inventory cost, reject cost and delivery cost. Equations 2 to 12 show the model constraints. Stock quantity in period t depend on quantity of stock from previous period, number of rejected stock, incoming and outgoing product (Eq. 2). Eq. 3 shows rejected quantity is equal to rejected rate times quantity of stock. Maximum stock quantity every period cannot overcome store capacity (eq. 4). Stock quantity in every store every period must be bigger than minimum

stock (5). Delivery quantity of each vendor is equal to capacity delivery to all store (6). Whenever there is delivery from i to j, then the vehicle will outbound from j (7). Eq. 8 shows delivery quantity when number of stock less than the maximum stock.

0.1 Genetic Algorithm

Genetic algorithm used in this paper is a simple GA with:

1) Chromosome representation



Chromosome represents three variables which are minimum stock, maximum stock, and routing for each period. Minimum and maximum stocks are represented using integer values as shown in Figure 1. Notation for the minimum stock is L_i and the maximum stock is M_i.

Figure 1. Minimum and maximum stock chromosome

The third variable is delivery routing for each period. A chromosome is represented by integer values that show the sequence of the store that are visited by the vehicle. When one store is not visited due to enough stock, then the chromosome is represented by zero (0). Chromosome for vehicle routing can be seen in Figure 2.

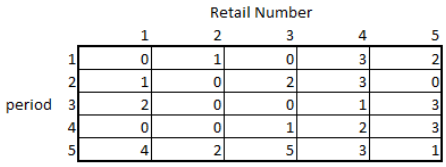


Figure 2. Chromosome representation for vehicle routing

2) Fitness function and selection

The GA fitness function is derived from equation 1 and parents selection is using roulette wheel rule where chromosome with less fitness value has a higher possibility to be chosen as parents.

3) *Crossover*

The *Crossover* method that is used in this paper is a one-point crossover.

4) *Mutation*

The Mutation process is done inside of one chromosome where each cell has 40% possibility to be mutated. When a cell is chosen to be mutated, it changes randomly between a specific minimum and maximum values.

5) *Elitism*

Elitism is a process to keep the best chromosome in each generation automatically become an offspring in the next generation.

6) *Stopping criteria*

Stopping criteria set the GA method to be stopped. In this paper stopping criteria is using a predetermined number of generations.

0.2 Particle Swarm Optimization

Particle Swarm Optimization algorithm works as particles move together to follow the positions that have been found so far. Some important things that have to be set up to get good PSO are particle representation, position, velocity, fitness function, global best, and local best.

1) Particle representation

Particle representation for minimum and maximum stock is similar to chromosome representation in GA, however, vehicle routing representation is different. PSO uses float values instead of the sequence as shown in GA. Particle representation for vehicle routing is shown in Figure 3. The sequence of the vehicle will follow the particle from the lowest to the highest values where value 0 shows that the retail is not visited at that period. For example route for the vehicle in period one in Figure 3 is from the vendor to stores 4-2-5 and return to vendor.

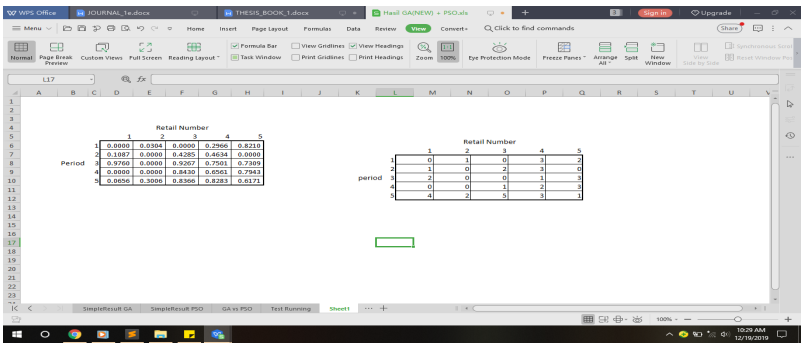


Figure 3. Particle representation of vehicle routing

2) Particle velocity

Particle velocity will be updated at every iteration to move every particle closer to the best particle in local and global position. The velocity for each particle can be updated using equation 12.

$$v_i^{k+1} = wv_i^k + c_1 rand_1 \times \left(pbest_i - p_i^k\right) + c_2 rand_2 \times \left(gbest - p_i^k\right) \tag{12}$$

Where the gbest is the best particle position for all previous iteration and pbest is the position of a particle from the previous iteration.

3) Particle position

The later position of each particle is moved with his velocity as shown in equation 13.Particle position

Later position of each particle is moved with his own velocity as shown in equation 13.

$$p_i^{k+1} = p_i^k + v_i^{k+1} \tag{13}$$

4) Fitness value

The fitness value is similar to the GA fitness value, where the fitness value is derived from equation 1.

5) The best solution and stopping criteria

The best solution is derived form the best solution from the last iteration where the number of iteration is determined at advanced.

A NUMERICAL EXAMPLE AND RESULT

The numerical example uses the main data from data generation. There are two types of demand, the first case is dynamic demand and the second case is static demand. Demand data is generated uniformly from 20-60. The other data such as distance, inventory cost, warehouse capacity at each store, initial stock, delivery capacity, and product price are generated consecutively 10, 5, uniform [20 - 50], uniform [10 - 25], uniform [60 - 100], uniform [60 - 100], 750, and 40.

We set varies of population size and the number of iterations to get the best parameter for the Genetic Algorithm for both cases. The best fitness function for case 2 is shown in Figure 4.

Figure 4. The best fitness value for case 2 with 250 Iteration and 140 population

Figure 4 shows that the GA is not trapped to local optimal easily. The two cases show that at least the solutions convergent at the 200th generation. We set the number of generations is equal to 250 to guarantee that the solution has been convergent and the best solution is 18.65% less than the initial fitness value. Therefore the GA result in significant improvement compares to the initial solution.

For the PSO there are 32 combinations of the population (P), iteration (G), and cases. The best solution for case 1 is derived from 250 iterations and 140 population. The best fitness values for case 1 is shown in Figure 5. The solutions show that the longest iteration for getting the best fitness values convergent is 198 iteration, therefore we set the number of iteration is 250 to guarantee that the best fitness value has been convergent. The best fitness value of PSO is 32.14% better than the initial solution.

Figure 5. The PSO best fitness value for case 1 with 250 Iteration and 140 population

The best solution for case 1 and case 2 for GA and PSO are shown in Table 1. The table shows that the PSO outperforms GA in terms of the best fitness value and computation time, therefore we use PSO to get management insight of static and dynamic demand.

Table 1. The optimal values and running time of GA and PSO

	Optimal Cost		Running Time (s)	
Simulation	**GA**	**PSO**	**GA**	**PSO**
Case 1	45123	44296,6	3311	2850
Case 2	41297,2	41058,6	3281	2659
Case 3	32568	32164,4	3587	3226

0.3 Table 2 shows a comparison between case 1 with dynamic demand and case 2 with static demand. The table shows that dynamic static has less inventory cost but higher spoilage cost and delivery cost, however, the spoilage and delivery cost is not significantly. Case 1 has a higher cost than case 2 since stores have to keep more stocks to prevent lost sales. The dynamic demand results in a 9.1% higher inventory cost than static demand. Therefore, important for organizations to keep demand as stable as possible in each period to reduce inventory cost.

Table 2. Fitness values for case 1 and case 2

Demand Case 1	
Holding Cost	35362.6
Spoilage Cost	8032
Route Cost	737.8
Penalty	0
Fitness Value	**44132.4**

Demand Case 2	
Holding Cost	32421.4
Spoilage Cost	8096
Route Cost	795
Penalty	0
Fitness Value	**41312.4**

Demand Case 3	
Holding Cost	25091.2
Spoilage Cost	6472
Route Cost	763
Penalty	0
Fitness Value	**32326.2**

A sensitivity analysis is used to evaluate the effect of spoilage rate to the total cost. We use spoilage rate 5% , 7% , and 9% and keep all parameters at the same values. The sensitivity analysis result is shown in Table 3.

Table 3. Fitness values for varies of spoilage rate

Spoilage Rate 5%	
Holding Cost	23382.4
Spoilage Cost	3840
Route Cost	808
Fitness Value	**28030.4**

Spoilage Rate 7%	
Holding Cost	24292
Spoilage Cost	4824
Route Cost	902
Fitness Value	**30018**

Spoilage Rate 9%	
Holding Cost	25069.6
Spoilage Cost	5376
Route Cost	699
Fitness Value	**31144.6**

Table 3 shows an increasing 2% spoilage rate form 5% to 7% result in increasing holding costs from 3% to 4% and increasing spoilage cast from 11% to 26% . It shows that the spoilage rate significantly affect holding cost and spoilage cost, therefore this model is suitable to be used for items with high spoilage cost such as vegetables, fruits, and meats. For the set parameter values determined in this numerical example, the holding cost is the highest cost for the fitness values.

CONCLUSION

Inventory routing problem is one important model to be used in the vendor manage inventory scheme, where the vendor delivers and keeps his stock to some retail stores. In this paper, IRP for spoilage items since spoilage items such as fruits and vegetables are common and reality. Instead of considering static demand, this paper considers dynamic demand. The model is an NP-hard problem therefore Genetic Algorithm and Particle Swarm Optimization are developed to solve the problem. Both methods are effective to solve IRP problems. A numerical example is used to compare the performance of both methods. The results show that the PSO outperforms GA in terms of solution quality and computation time and the total cost for dynamic demand is 9% higher than the total cost of static demand. A sensitivity analysis is conducted to analyst the effect of spoilage rate to the total cost. The sensitivity analysis shows that the spoilage rate significantly affects the total cost. The numerical example and sensitivity analysis show that this model is very important to be used to handle spoilage items and dynamic demand. This paper assumes that there is no transshipment between stores, therefore the next research can consider transshipment since transshipment is common to be used by some retail stores to reduce costs. The other future research by considering environmental issues for delivering items.

References

[1] Aghezzaf E-H., Raa B., & Landeghem H.H. (2006). Modeling inventory routing problems in supply chains of high consumption products, European Journal of Operational Research, 169, 1048-1063.

[2] Azadeh, A., Elahi, S., Farahani, M. H., & Nasirian, B. (2017). A genetic algorithm-Taguchi based approach to inventory routing problem of a single perishable product with transshipment. *Computers & Industrial Engineering, 104*, 124-133. doi:10.1016/j.cie.2016.12.019

[3] Coelho L.C., Cordeau J.F., & Laporte G. (2014). Thirty years of inventory routing, Transportation Science, 48 (1), 1-19.

[4] Guimarães, T., Coelho, L., Schenekemberg, C., & Scarpin, C. (2019). The two-echelon multi-depot inventory-routing problem. *Computers & Operations Research, 101*, 220-233. doi:10.1016/j.cor.2018.07.024

[5] Hiassat, A., Diabat, A., & Rahwan, I. (2017). A genetic algorithm approach for location-inventory-routing problem with perishable products. *Journal of Manufacturing Systems, 42*, 93-103. doi:10.1016/j.jmsy.2016.10.004.

[6] Huang S-H., & Lin P-C., (2010). A modified ant colony optimization algorithm for multi-item inventory routing problems with demand uncertainty, Transportation Research Part E, 46, 598-611.

[7] Hu, W., Toriello, A., & Dessouky, M. (2018). Integrated inventory routing and freight consolidation for perishable goods. *European Journal of Operational Research, 271*(2), 548-560. doi:10.1016/j.ejor.2018.05.034.

[8] Ketzenberg, M., Gaukler, G., & Salin, V. (2018). Expiration dates and order quantities for perishables. *European Journal of Operational Research, 266*(2), 569-584. doi:10.1016/j.ejor.2017.10.005

[9] Liu S-C., & Lee W-T. (2011). A heuristic method for the inventory routing problem with time windows, Expert Systems with Applications, 38, 13223-13231.

[10] Norouzi, N., Sadegh-Amalnick, M., & Alinaghiyan, M. (2015). Evaluating of the particle swarm optimization in a periodic vehicle routing problem. *Measurement, 62*, 162-169. doi:10.1016/j.measurement.2014.10.024.

[11] Rau H., Budiman S.D., and Widyadana G.A., Optimization of the multi-objective gree cyclical inventory routing problem using discrete multi-awarm PSO method, Transportation Research Part E:Logistics and Transportation Review, 120, 51-75.

[12] Rohmer, S. U. K., Claassen, G. D. H., & Laporte, G. (2019). A two-echelon inventory routing problem for perishable products. *Computers & Operations Research, 107*, 156-172. doi:10.1016/j.cor.2019.03.015.

[13] Sadeghi, J., Sadeghi, S., & Niaki, S. T. A. (2014). Optimizing a hybrid vendor-managed inventory and transportation problem with fuzzy demand: An improved particle swarm optimization algorithm. *Information Sciences, 272*, 126-144. doi:10.1016/j.ins.2014.02.075

[14] Savelsbergh M. and Song J.H. (2007). Inventory routing with continuous moves, Computers & Operations Research, 34, 1744-1763.

[15] Widyadana G.A., and Irohara T., (2019) Modelling multi-tour inventory problem for deteriorating items with time windows, Scienta Iranica, 26(2), 932-941.

[16] Yadollahi, E., Aghezzaf, E.-H., Walraevens, J., Raa, B., & Claeys, D. (2019). Evaluating approximate solution models for the stochastic periodic inventory routing problem. *Journal of Manufacturing Systems, 50*, 25-35. doi:10.1016/j.jmsy.2018.11.001

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Revision _19

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Aspect	Behaviour		
	Yes	No	Remarks
The summary is informative, and it has summary and abstract		N	Abstract does not seems to be appropriate
It has the key words in English, and these are informative		N	There are no key words
It proposes a code of the MSC and this is correct		N	There is no MSC code
The reported bibliography is referred in the text	Y		
The bibliography referred in the text is reported	Y		
The reported bibliography is adequate and actual	Y		It is sufficient
The title is informative and correct		N	Title unable to express - What is new in the proposed paper?
The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	

The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

Detailed Review:

Abstract	Text Box: 1. Abstract is not clear and does not appeal to read the paper. 2. There are no key words.
Literature survey	Text Box: 1. Reference [1] is referred twice with different author names in literature survey. 2. Contribution of authors is not written systematically.
Model	Text Box: 1. General theory of GA and PSO is mentioned. 2. All the tables and results are in picture format. 3. Units for numerical data is missing. 4. Transportation cost is not considered which need to be included in any IRP. 5. Structure of sentences are not appropriate at many places.
Interpretations	Text Box: 1. There is no concrete interpretation or conclusion made from the model.
Results	Text Box: 1. Application and usage of the model and results for managerial point of view are not discussed.

Recommendations to the editor:

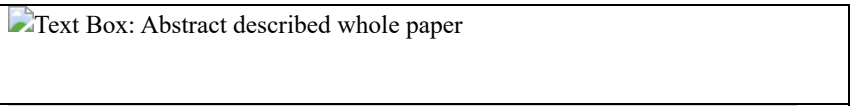
Criteria	**Y/N**
Accept as it is	N
Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate
Paper Id: YUJOR_19
Reviewer's Name:

Aspect	**Behaviour**		
	Yes	**No**	**Remarks**
The summary is informative, and it has summary and abstract	yes		
It has the key words in English, and these are informative	Yes		
It proposes a code of the MSC and this is correct			Not given
The reported bibliography is referred in the text	Yes		
The bibliography referred in the text is reported	Yes		

The reported bibliography is adequate and actual	Yes		
The title is informative and correct	Yes		
The paper is a theoretical contribution		No	It has a practical application
The paper is an original application	Yes		
The paper contributes with at least an original and important algorithm	Yes		
The formulas and algorithms are well formulated	Yes		
The writing is good and there are not spelling mistakes	Yes		Please correct typo error

Detailed Review:

Abstract	
Literature survey	
Model	
Interpretations	
Results	Please specify GA and PSO parameters value (population size, mutation and crossover rate, maximum generation, inertia weight, c1, c2 etc.). Also mention the software/tool used for execution of the algorithm.

Recommendations to the editor:

Criteria	Y/N
Accept as it is	
Accept with minor revision	Y
Accept with major revision	
Reject	
Results	

With best regards

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On Mon, May 11, 2020 at 10:29 AM Dr. Mandeep Mittal <mittal_mandeep@yahoo.com> wrote:

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Former Head- Department of Mathematics
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Mobile: +91-98-914-02516
E-mail: mmittal@amity.edu

Post-Doctoral Fellow: Hanyang University, South Korea (2015-2016)

----- Forwarded message -----
From: Ketua Prodi Magister Teknik Industri <kj-mti@petra.ac.id>
To: "mittal_mandeep@yahoo.com" <mittal_mandeep@yahoo.com>
Sent: Sunday, 10 May 2020, 11:55:01 pm GMT+5:30
Subject: Yujor paper Gede

Dear Prof. Mandeep,

Herewith I send my paper and sorry for my lateness.

Best Regards,
Gede

I Gede Agus Widyadana <gede@petra.ac.id> Fri, May 29, 2020 at 5:07 PM
To: Krisna Wahyudi <krisnawahyudi17@gmail.com>, Nyoman Sutapa <mantapa@petra.ac.id>

Pak Nyoman dan Krisna, ini hasil sementara pengiriman full papernya tesis Krisna ke Yujjor. Sebagian dari ini yang hanya GA nya saja dikirim ke Jirae, tapi kalau ini duluan yang diterima yg di jirae akan ditarik karena lucu bagian kecilnya mengutip yang besar. Kalau Jirae duluan terbit, bisa kita kutip di sini.
Terlampir juga sebagian paper yang sudah saya revisi, tapi masih belum selesai. Mungkin ada masukan dari P Nyoman atau Krisna.

Terima kasih,
Gede

---------- Forwarded message ---------
From: **Special Issue YUJOR** <specialissueyujor@gmail.com>
Date: Sat, May 23, 2020 at 10:27 PM
Subject: Revision _19
To: <kj-mti@petra.ac.id>, <gede@petra.ac.id>
Cc: <nitahshah@gmail.com>, vijay kumar <vijay_parashar@yahoo.com>

Special Issue YUJOR <specialissueyujor@gmail.com> Sat, May 9, 3:01 PM
to saurabhpanwar89, vivekrajput.du.aor, pkkapur1

Top Urgent:

Dear Author(s)

We have received review comments for your submitted paper. Kindly revise your paper as suggested by the reviewers.

You are requested to submit the following within 15 days:
1. Responses to reviewer's comments separately in a file

2. Revised doc file after highlighting reviewers' response
3. Latex file as per YUJOR template

Kindly acknowledge this email.

Find below reviewers' comments.

Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate
Paper Id:
Reviewer's Name: xyz

Aspect	Behaviour		
	Yes	**No**	**Remarks**
The summary is informative, and it has summary and abstract		N	Abstract does not seems to be appropriate
It has the key words in English, and these are informative		N	There are no key words
It proposes a code of the MSC and this is correct		N	There is no MSC code
The reported bibliography is referred in the text	Y		
The bibliography referred in the text is reported	Y		
The reported bibliography is adequate and actual	Y		It is sufficient
The title is informative and correct		N	Title unable to express - What is new in the proposed paper?
The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	
The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

Detailed Review:

Abstract	Text Box: 1. Abstract is not clear and does not appeal to read the paper. 2. There are no key words.
Literature survey	Text Box: 1. Reference [1] is referred twice with different author names in literature survey. 2. Contribution of authors is not written systematically.
Model	Text Box: 1. General theory of GA and PSO is mentioned. 2. All the tables and results are in picture format. 3. Units for numerical data is missing. 4. Transportation cost is not considered which need to be included in any IRP. 5. Structure of sentences are not appropriate at many places.

Interpretations	Text Box: 1. There is no concrete interpretation or conclusion made from the model.
Results	Text Box: 1. Application and usage of the model and results for managerial point of view are not discussed.

Recommendations to the editor:

Criteria	**Y/N**
Accept as it is	N
Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate
Paper Id: YUJOR_19
Reviewer's Name:

Aspect	**Behaviour**		
	Yes	**No**	**Remarks**
The summary is informative, and it has summary and abstract	yes		
It has the key words in English, and these are informative	Yes		
It proposes a code of the MSC and this is correct			Not given
The reported bibliography is referred in the text	Yes		
The bibliography referred in the text is reported	Yes		
The reported bibliography is adequate and actual	Yes		
The title is informative and correct	Yes		
The paper is a theoretical contribution		No	It has a practical application
The paper is an original application	Yes		
The paper contributes with at least an original and important algorithm	Yes		
The formulas and algorithms are well formulated	Yes		
The writing is good and there are not spelling mistakes	Yes		Please correct typo error

Detailed Review:

Abstract	Text Box: Abstract described whole paper
Literature survey	
Model	

Interpretations	
Results	Please specify GA and PSO parameters value (population size, mutation and crossover rate, maximum generation, inertia weight, c1, c2 etc.). Also mention the software/tool used for execution of the algorithm.

Recommendations to the editor:

Criteria	Y/N
Accept as it is	
Accept with minor revision	Y
Accept with major revision	
Reject	
Results	

With best regards

Editor(s)
Special Issue YUJOR
Prof. Nita H Shah, +91 98252 61816
Dr. Mandeep Mittal, +91 9891402516
Dr. Vijay Kumar, +91 9891330520

On Mon, May 11, 2020 at 10:29 AM Dr. Mandeep Mittal <mittal_mandeep@yahoo.com> wrote:

> With regards,
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An IRP for deteriorating items with dynamic demand and deteriorating rate Yujor rev.docx
153K

Special Issue YUJOR <specialissueyujor@gmail.com> Tue, Jun 2, 2020 at 12:58 PM
To: kj-mti@petra.ac.id, gede@petra.ac.id
Cc: nitahshah@gmail.com, vijay kumar <vijay_parashar@yahoo.com>

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Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

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To: kj-mti@petra.ac.id, gede@petra.ac.id
Cc: nitahshah@gmail.com, vijay kumar <vijay_parashar@yahoo.com>

3rd Reminder

Kindly submit the revision.

With best regards

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Special Issue YUJOR
Prof. Nita H Shah, +91 98252 61816
Dr. Mandeep Mittal, +91 9891402516
Dr. Vijay Kumar, +91 9891330520

On Tue, Jun 2, 2020 at 11:28 AM Special Issue YUJOR <specialissueyujor@gmail.com> wrote:

Dear Author

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Reviewer's Name: xyz

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The reported bibliography is adequate and actual	Y		It is sufficient
The title is informative and correct		N	Title unable to express - What is new in the proposed paper?
The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	
The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

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Criteria	**Y/N**
Accept as it is	N
Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

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Paper Id: YUJOR_19
Reviewer's Name:

Aspect	**Behaviour**		
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It has the key words in English, and these are informative	Yes		
It proposes a code of the MSC and this is correct			Not given
The reported bibliography is referred in the text	Yes		
The bibliography referred in the text is reported	Yes		
The reported bibliography is adequate and actual	Yes		
The title is informative and correct	Yes		
The paper is a theoretical contribution		No	It has a practical application
The paper is an original application	Yes		
The paper contributes with at least an original and important algorithm	Yes		
The formulas and algorithms are well formulated	Yes		
The writing is good and there are not spelling mistakes	Yes		Please correct typo error

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Literature survey	
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Accept with minor revision	Y
Accept with major revision	
Reject	
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With best regards

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Prof. Nita H Shah, +91 98252 61816
Dr. Mandeep Mittal, +91 9891402516
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Special Issue YUJOR <specialissueyujor@gmail.com> Tue, Jun 16, 2020 at 3:19 PM
To: kj-mti@petra.ac.id, gede@petra.ac.id

4th Reminder

Dear Author

We are not getting any reply from your side on email and Whatsapp.

I hope all fine your side

You are requested to submit a revision within 2 days in latex format with a response sheet.

Thank you

With best regards

Editor(s)
Special Issue YUJOR
Prof. Nita H Shah, +91 98252 61816
Dr. Mandeep Mittal, +91 9891402516
Dr. Vijay Kumar, +91 9891330520

On Fri, Jun 12, 2020 at 4:48 PM Special Issue YUJOR <specialissueyujor@gmail.com> wrote:

3rd Reminder

Kindly submit the revision.

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Editor(s)
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Paper Id:
Reviewer's Name: xyz

Aspect	Behaviour		
	Yes	No	Remarks
The summary is informative, and it has summary and abstract		N	Abstract does not seems to be appropriate
It has the key words in English, and these are informative		N	There are no key words
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The reported bibliography is referred in the text	Y		
The bibliography referred in the text is reported	Y		
The reported bibliography is adequate and actual	Y		It is sufficient
The title is informative and correct		N	Title unable to express - What is new in the proposed paper?
The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	
The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

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Interpretations	Text Box: 1. There is no concrete interpretation or conclusion made from the model.
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Accept as it is	N
Accept with minor revision	N
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Reject	N
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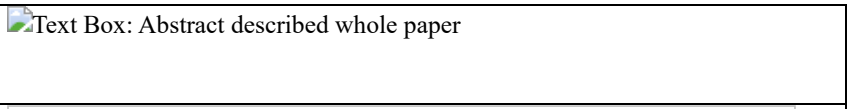
Detailed Review:

Abstract	
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To: Special Issue YUJOR <specialissueyujor@gmail.com>

Thank you for valuable feedback dan sorry for my late response. I have a problem for using Yujor Latex template, therefore in this attachment, I convert from word to latex using converter website and still trying to use Yujor Latex format. I put my revision in blue characters.

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Gede

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Literature survey	Text Box: 1. Reference [1] is referred twice with different author names in literature survey. 2. Contribution of authors is not written systematically.
Model	Text Box: 1. General theory of GA and PSO is mentioned. 2. All the tables and results are in picture format. 3. Units for numerical data is missing. 4. Transportation cost is not considered which need to be included in any IRP. 5. Structure of sentences are not appropriate at many places.

Interpretations	Text Box: 1. There is no concrete interpretation or conclusion made from the model.
Results	Text Box: 1. Application and usage of the model and results for managerial point of view are not discussed.

Recommendations to the editor:

Criteria	**Y/N**
Accept as it is	N
Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate
Paper Id: YUJOR_19
Reviewer's Name:

Aspect	**Behaviour**		
	Yes	**No**	**Remarks**
The summary is informative, and it has summary and abstract	yes		
It has the key words in English, and these are informative	Yes		
It proposes a code of the MSC and this is correct			Not given
The reported bibliography is referred in the text	Yes		
The bibliography referred in the text is reported	Yes		
The reported bibliography is adequate and actual	Yes		
The title is informative and correct	Yes		
The paper is a theoretical contribution		No	It has a practical application
The paper is an original application	Yes		
The paper contributes with at least an original and important algorithm	Yes		
The formulas and algorithms are well formulated	Yes		
The writing is good and there are not spelling mistakes	Yes		Please correct typo error

Detailed Review:

Abstract	Text Box: Abstract described whole paper
Literature survey	
Model	

Interpretations	
Results	Please specify GA and PSO parameters value (population size, mutation and crossover rate, maximum generation, inertia weight, c1, c2 etc.). Also mention the software/tool used for execution of the algorithm.

Recommendations to the editor:

Criteria	Y/N
Accept as it is	
Accept with minor revision	Y
Accept with major revision	
Reject	
Results	

With best regards

Editor(s)
Special Issue YUJOR
Prof. Nita H Shah, +91 98252 61816
Dr. Mandeep Mittal, +91 9891402516
Dr. Vijay Kumar, +91 9891330520

On Mon, May 11, 2020 at 10:29 AM Dr. Mandeep Mittal <mittal_mandeep@yahoo.com> wrote:

With regards,

Dr. Mandeep Mittal
Associate Professor
Ph.D., Post Doc

Room No. 13, E 2 - 402
Department of Mathematics
Amity Institute of Applied Sciences
Amity University Noida
Sector-125, Noida
UP- 201313, India

Former Dean-SA (2006-2015)
Former Head- Department of Mathematics
Amity School of Engineering and Technology, Delhi

Mobile: +91-98-914-02516
E-mail: mmittal@amity.edu

Post-Doctoral Fellow: Hanyang University, South Korea (2015-2016)

----- Forwarded message -----

From: Ketua Prodi Magister Teknik Industri <kj-mti@petra.ac.id>
To: "mittal_mandeep@yahoo.com" <mittal_mandeep@yahoo.com>
Sent: Sunday, 10 May 2020, 11:55:01 pm GMT+5:30
Subject: Yujor paper Gede

Dear Prof. Mandeep,

Herewith I send my paper and sorry for my lateness.

Best Regards,
Gede

An IRP for deteriorating items with dynamic demand and deteriorating rate Yujor rev.zip
434K

Special Issue YUJOR <specialissueyujor@gmail.com> Mon, Jun 22, 2020 at 1:21 PM
To: I Gede Agus Widyadana <gede@petra.ac.id>

Congratulations!

You are requested to submit the **Final Version** of the paper. You are required to follow the following points before the final submission:

1- Follow the guidelines of the Journal for final submission:
http://yujor.fon.bg.ac.rs/index.php/yujor/about/submissions
2- Your paper must have less than 15% plagiarism. It must be less than 5% from one link. Kindly submit Plag. report with final version.
3- You are required to submit Latex file of the final version of the paper. **Paper length must not be more than 10 pages.** Additionally, you must follow the copyright rules and regulation like:

"The copyright includes ideas, figures, data, etc. of the research in the paper; changing just a part of the text is not enough to change the original copyright if the expanded/changed paper still has figures, data, ideas, etc. from the research already published in the original paper.

Kindly submit your final version of the **paper on or before 3 days.** Final version of the paper will not be accepted if the above three points will not be followed in the final version.

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With best regards

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Kindly acknowledge this email.

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Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate
Paper Id:
Reviewer's Name: xyz

Aspect	Behaviour		
	Yes	No	Remarks
The summary is informative, and it has summary and abstract		N	Abstract does not seems to be appropriate
It has the key words in English, and these are informative		N	There are no key words
It proposes a code of the MSC and this is correct		N	There is no MSC code
The reported bibliography is referred in the text	Y		
The bibliography referred in the text is reported	Y		
The reported bibliography is adequate and actual	Y		It is sufficient
The title is informative and correct		N	Title unable to express - What is new in the proposed paper?
The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	
The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

Detailed Review:

Abstract	Text Box: 1. Abstract is not clear and does not appeal to read the paper. 2. There are no key words.
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Interpretations	Text Box: 1. There is no concrete interpretation or conclusion made from the model.
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Recommendations to the editor:

Criteria	**Y/N**
Accept as it is	N
Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

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Paper Id: YUJOR_19
Reviewer's Name:

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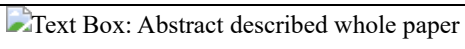
It has the key words in English, and these are informative	Yes		
It proposes a code of the MSC and this is correct			Not given
The reported bibliography is referred in the text	Yes		
The bibliography referred in the text is reported	Yes		
The reported bibliography is adequate and actual	Yes		
The title is informative and correct	Yes		
The paper is a theoretical contribution		No	It has a practical application
The paper is an original application	Yes		

The paper contributes with at least an original and important algorithm	Yes		
The formulas and algorithms are well formulated	Yes		
The writing is good and there are not spelling mistakes	Yes		Please correct typo error

Detailed Review:

Abstract	
Literature survey	
Model	
Interpretations	
Results	Please specify GA and PSO parameters value (population size, mutation and crossover rate, maximum generation, inertia weight, c1, c2 etc.). Also mention the software/tool used for execution of the algorithm.

Recommendations to the editor:

Criteria	**Y/N**
Accept as it is	
Accept with minor revision	Y
Accept with major revision	
Reject	
Results	

With best regards

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Dear Prof. Mandeep,

Herewith I send my paper and sorry for my lateness.

Best Regards,
Gede

I Gede Agus Widyadana <gede@petra.ac.id> Thu, Jul 2, 2020 at 10:57 AM
To: Special Issue YUJOR <specialissueyujor@gmail.com>

Dear editor,

Sorry for my late response.Herewith I attach my paper in Yujor format and the plagiarism check.

Best Regards,
Gede

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With best regards

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Kindly acknowledge this email.

Find below reviewers' comments.

Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate
Paper Id:
Reviewer's Name: xyz

Aspect	Behaviour		
	Yes	No	Remarks
The summary is informative, and it has summary and abstract		N	Abstract does not seems to be appropriate
It has the key words in English, and these are informative		N	There are no key words
It proposes a code of the MSC and this is		N	There is no MSC code

correct			
The reported bibliography is referred in the text	Y		
The bibliography referred in the text is reported	Y		
The reported bibliography is adequate and actual	Y		It is sufficient
The title is informative and correct		N	Title unable to express - What is new in the proposed paper?
The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	
The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

Detailed Review:

Abstract	 Text Box: 1. Abstract is not clear and does not appeal to read the paper. 2. There are no key words.
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Results	 Text Box: 1. Application and usage of the model and results for managerial point of view are not discussed.

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Criteria	**Y/N**
Accept as it is	N
Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate
Paper Id: YUJOR_19
Reviewer's Name:

Aspect	Behaviour		
	Yes	**No**	**Remarks**
The summary is informative, and it has summary and abstract	yes		
It has the key words in English, and these are informative	Yes		
It proposes a code of the MSC and this is correct			Not given
The reported bibliography is referred in the text	Yes		
The bibliography referred in the text is reported	Yes		
The reported bibliography is adequate and actual	Yes		
The title is informative and correct	Yes		
The paper is a theoretical contribution		No	It has a practical application
The paper is an original application	Yes		
The paper contributes with at least an original and important algorithm	Yes		
The formulas and algorithms are well formulated	Yes		
The writing is good and there are not spelling mistakes	Yes		Please correct typo error

Detailed Review:

Abstract	Text Box: Abstract described whole paper
Literature survey	
Model	
Interpretations	
Results	Please specify GA and PSO parameters value (population size, mutation and crossover rate, maximum generation, inertia weight, c1, c2 etc.). Also mention the software/tool used for execution of the algorithm.

Recommendations to the editor:

Criteria	**Y/N**
Accept as it is	
Accept with minor revision	Y
Accept with major revision	
Reject	
Results	

With best regards

Editor(s)
Special Issue YUJOR
Prof. Nita H Shah, +91 98252 61816
Dr. Mandeep Mittal, +91 9891402516
Dr. Vijay Kumar, +91 9891330520

On Mon, May 11, 2020 at 10:29 AM Dr. Mandeep Mittal <mittal_mandeep@yahoo.com> wrote:

With regards,

Dr. Mandeep Mittal
Associate Professor
Ph.D., Post Doc

Room No. 13, E 2 - 402
Department of Mathematics
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Amity University Noida
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Dear Prof. Mandeep,

Herewith I send my paper and sorry for my lateness.

Best Regards,
Gede

2 attachments

Deteriorating_items_Yujor_Final.tex
39K

yujor.pdf
1775K

UNIVERSITAS KRISTEN PETRA

I Gede Agus Widyadana <gede@petra.ac.id>

Urgent: Revision _19

3 messages

Dr. Mandeep Mittal <mittal_mandeep@yahoo.com> Thu, Aug 13, 2020 at 1:00 AM
Reply-To: "Dr. Mandeep Mittal" <mittal_mandeep@yahoo.com>
To: "I. Gede Agus Widyadana" <gede@petra.ac.id>

Dear Professor

Kindly send response sheet of the reviewers comments. We need response sheet for record. As per your email, you have written revisions are in blue color characters but we need response sheet separately (MS word file) and revision file with blue color characters (MS word file). Your Tex file is giving error now during compilation.

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Find below reviewers' comments.

Title of the Paper: **An inventory routing problem for deteriorating items with dynamic demand and spoilage rate**
Paper Id:
Reviewer's Name: **xyz**

Aspect	Behaviour		
	Yes	No	Remarks
The summary is informative, and it has summary and abstract		N	Abstract does not seems to be appropriate

It has the key words in English, and these are informative		N	There are no key words
It proposes a code of the MSC and this is correct		N	There is no MSC code
The reported bibliography is referred in the text	Y		
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The title is informative and correct		N	Title unable to express - What is new in the proposed paper?
The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	
The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

Detailed Review:

Abstract	
Literature survey	
Model	
Interpretations	

Results	

Recommendations to the editor:

Criteria	Y/N
Accept as it is	N
Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate

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The bibliography referred in the text is reported	Yes		
The reported bibliography is adequate and actual	Yes		
The title is informative and correct	Yes		
The paper is a theoretical contribution		No	It has a practical application
The paper is an original application	Yes		
The paper contributes with at least an original and important algorithm	Yes		

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The writing is good and there are not spelling mistakes	Yes		Please correct typo error

Detailed Review:

Abstract	
Literature survey	
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yujor.pdf
1775K

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To: "Dr. Mandeep Mittal" <mittal_mandeep@yahoo.com>

Dear Prof. Mittal herewith I send the answer of the reviewers comments and revised paper on word. I am still try to put the paper in the correct latex format.

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The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	
The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

Detailed Review:

Abstract	

Literature survey	
Model	
Interpretations	
Results	

Recommendations to the editor:

Criteria	**Y/N**
Accept as it is	N
Accept with minor revision	N
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Reject	N
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Accept as it is	
Accept with minor revision	Y
Accept with major revision	
Reject	

Results	

With best regards

Editor(s)
Special Issue YUJOR
Prof. Nita H Shah, +91 98252 61816
Dr. Mandeep Mittal, +91 9891402516
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On Mon, May 11, 2020 at 10:29 AM Dr. Mandeep Mittal <mittal_mandeep@yahoo.com> wrote:

With regards,

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Ph.D., Post Doc

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----- Forwarded message -----
From: Ketua Prodi Magister Teknik Industri <kj-mti@petra.ac.id>
To: "mittal_mandeep@yahoo.com" <mittal_mandeep@yahoo.com>
Sent: Sunday, 10 May 2020, 11:55:01 pm GMT+5:30
Subject: Yujor paper Gede

Dear Prof. Mandeep,

Herewith I send my paper and sorry for my lateness.

Best Regards,
Gede

2 attachments

An IRP for deteriorating items with dynamic demand and deteriorating rate Yujor rev 3.docx
154K

Response to reviewer comments yujor.docx
20K

Dr. Mandeep Mittal <mittal_mandeep@yahoo.com>
Reply-To: "Dr. Mandeep Mittal" <mittal_mandeep@yahoo.com>
To: I Gede Agus Widyadana <gede@petra.ac.id>

Fri, Aug 14, 2020 at 1:29 PM

thanks

With regards,

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On Thursday, 13 August, 2020, 11:03:17 pm IST, I Gede Agus Widyadana <gede@petra.ac.id> wrote:

Dear Prof. Mittal herewith I send the answer of the reviewers comments and revised paper on word. I am still try to put the paper in the correct latex format.

Best Regards,
Gede

On Thu, Aug 13, 2020 at 1:01 AM Dr. Mandeep Mittal <mittal_mandeep@yahoo.com> wrote:

> Dear Professor
>
> Kindly send response sheet of the reviewers comments. We need response sheet for record. As per your email, you have written revisions are in blue color characters but we need response sheet separately (MS word file) and revision file with blue color characters (MS word file). Your Tex file is giving error now during compilation.
>
> Plz send it on **Top urgent basis**.

Thank you for valuable feedback dan sorry for my late response. I have a problem for using Yujor Latex template, therefore in this attachment, I convert from word to latex using converter website and still trying to use Yujor Latex format. I put my revision in blue characters.

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Gede

On Sat, May 23, 2020 at 10:27 PM Special Issue YUJOR <specialissueyujor@gmail.com> wrote:

> **Special Issue YUJOR** <specialissueyujor@gmail.com>
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>
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>
> **We have received review comments for your submitted paper. Kindly revise your paper as suggested by the reviewers.**

You are requested to submit the following within 15 days:

1. Responses to reviewer's comments separately in a file

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3. Latex file as per YUJOR template

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Find below reviewers' comments.

Title of the Paper: **An inventory routing problem for deteriorating items with dynamic demand and spoilage rate**

Paper Id:

Reviewer's Name: **xyz**

Aspect	Behaviour		
	Yes	**No**	**Remarks**
The summary is informative, and it has summary and abstract		N	Abstract does not seems to be appropriate
It has the key words in English, and these are informative		N	There are no key words
It proposes a code of the MSC and this is correct		N	There is no MSC code
The reported bibliography is referred in the text	Y		
The bibliography referred in the text is reported	Y		
The reported bibliography is adequate and actual	Y		It is sufficient
The title is informative and correct		N	Title unable to express - What is new in the proposed paper?
The paper is a theoretical contribution		N	
The paper is an original application		N	
The paper contributes with at least an original and important algorithm		N	
The formulas and algorithms are well formulated	Y		Up to some extent well formulated but still not able to present properly
The writing is good and there are not spelling mistakes	Y		

Detailed Review:

Abstract	
Literature survey	
Model	

Interpretations	
Results	

Recommendations to the editor:

Criteria	Y/N
Accept as it is	N
Accept with minor revision	N
Accept with major revision	Y
Reject	N
Results	Needs major revision

Title of the Paper: An inventory routing problem for deteriorating items with dynamic demand and spoilage rate
Paper Id: YUJOR_19
Reviewer's Name:

Aspect	Behaviour		
	Yes	No	Remarks

The summary is informative, and it has summary and abstract	yes		
It has the key words in English, and these are informative	Yes		
It proposes a code of the MSC and this is correct			Not given
The reported bibliography is referred in the text	Yes		
The bibliography referred in the text is reported	Yes		
The reported bibliography is adequate and actual	Yes		
The title is informative and correct	Yes		
The paper is a theoretical contribution		No	It has a practical application
The paper is an original application	Yes		
The paper contributes with at least an original and important algorithm	Yes		
The formulas and algorithms are well formulated	Yes		
The writing is good and there are not spelling mistakes	Yes		Please correct typo error

Detailed Review:

Abstract	
Literature survey	
Model	
Interpretations	
Results	Please specify GA and PSO parameters value (population size, mutation and crossover rate, maximum generation, inertia weight, c1, c2 etc.). Also mention the software/tool used for execution of the algorithm.

Recommendations to the editor:

Criteria	**Y/N**
Accept as it is	
Accept with minor revision	Y
Accept with major revision	
Reject	
Results	

With best regards

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Dear Prof. Mandeep,

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Best Regards,
Gede

An inventory routing problem for deteriorating items with dynamic demand and spoilage rate

I Gede Agus Widyadana[a], Krisna Wahyudi[b], I Nyoman Sutapa[c]

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Abstract

Inventory routing problems (IRP) are one of an important tool to be used for implementing vendor manage inventory. Many researchers try to develop methods for solving inventory routing problem, however, only a few of them develop methods for inventory routing problems for spoilage items. In reality, many items are deteriorated and spoil during transportation and storage period, but not many papers deal with them since they are hard to be modeled and solved. In this paper, we develop a model and methods to solve the inventory routing problem for deteriorating items with dynamic demand and spoilage rate. The model are more realistic since many commodities such as fruits and vegetables have dynamic demand and spoilage rate. A Genetic Algorithm and Particle Swarm Optimization are developed to solve the problem in a specific planning period since the problem in an Np-hard problem. A numerical example for dynamic demand and static demand and sensitivity analysis are conducted to verify the model and to get management insights. The results show that PSO outperform GA in this model. The other finding support general hypothesis that the dynamic demand has higher total inventory cost than the static demand. The sensitivity analysis shows that increasing spoilage rate significantly affect the total cost, therefore the model is significantly useful to be used to minimize total inventory cost for IRP with dynamic demand and spoilage items.

Keywords: Inventory, spoilage, dynamic demand, Genetic Algorithm, Particle Swarm Optimization

MSC code: 65K10

INTRODUCTION

Inventory Routing Problem deals with inventory and distribution issues since both costs are dominant cost in the supply chain ([4] and [12]), therefore many organizations try to streamline stock holding and transportation expenses. The IRP is an optimization inventory problem for some stores by considering transportation costs. The goal of IRP is transportation and inventory cost minimization [16]. For more than 30 years, many researchers have given attention to the IRP and there are many variations of models and solutions that have been studied [3]. The IRP model includes IRP with the continuous move was introduced by [14]. Aghezzaf and Landeghem [1] developed IRP with multi-tours, and then stochastic demand IRP was introduced by [6] and Liu et.al. [9] developed an IRP model with time windows.

Recently many IRP models consider perishable items since perishable items are relevant for some important commodities such as fruits, vegetables, and meats. Perishable items have a random lifetime regarding environmental conditions such as temperature and humidity, the uncertainty of transportation time, and harvest time [8]. Hu et.al. [7] developed a simple IRP for perishable items and they developed decomposition and local search methods as efficient methods for solving the problem. The decomposition and local search is an efficient method, however to get more effective solution, metaheuristic methods can be applied. A Genetic Algorithm is used by [2] to solve an IRP problem with perishable items and single vendor. They extended IRP model by setting transshipment from one store to the other stores. A similar model and method for perishable items was developed by [5], however, they did not consider transshipment between stores. Widyadana and Irohara [15] extended IRP models for perishable items by considering deteriorated items and items are delivered under specific time windows. In the model, items are not only deteriorated during storing period in warehouses but the items are also deteriorating during the transportation period. The model are extended by [11], where they considered multi-objectives by regarding environmental issues in their model instead of one objective only.

In this model, we developed an IRP great model developed by [2] and introduce a new model for solving more realistic condition. We use dynamic demand instead of static demand and dynamic spoilage rate since difficult to predict spoilage rate for agriculture commodities such as vegetables, meats and fruits. We develop a model that is more realistic to be applied for agriculture items.

MODEL DEVELOPMENT

We developed the Inventory routing model in this paper using on [2] with dynamic demand and spoilage rate. Some assumptions that are used in this model are:

- Demand rate distribution during the replenishment period (T) is known.
- Deteriorating rate during replenishment period (T) is known

In this model we assume there is one product, one vendor and one delivery player with multi-period. Notations that are used in this paper are:

Parameters:

h_i	: Inventory cost at store I (\$)
T	: Replenishment period
M	: Numbers of store
$d_i(t)$	: Delivery volume from store i at period t
$Sr_i(t)$	: Deteriorating rate in store i at period t

$Sp_i(t)$: Number of reject in store i at period t

Q : Delivery capacity (unit)

c_{ij} : Delivery cost from store i to store j ($)

C_i : warehouse capacity at store i

Pr : Product price ($)

$I_i(0)$: Initial stock in store i

Variables

L_i : Minimum stock in store i

H_i : Maximum stock in store i

$X_{ij}(t)$: $\begin{cases} 1, if\ product\ delivered\ from\ store\ i\ to\ store\ j \\ 0, otherwise \end{cases}$

$q_i(t)$: Product quantity delivered to store i at period t

$$Min\ Z = \sum_{t=1}^{T}\sum_{i=1}^{M} h_i I_i(t) + Pr \sum_{t=1}^{T}\sum_{i=1}^{M} Sp_i(t) + \sum_{t=1}^{T}\sum_{i=1}^{M}\sum_{j=i+1}^{M} c_{ij} X_{ij}(t) \qquad (1)$$

Constraints:

$$I_i(t) = I_i(t-1) - Sp_i(t-1) + q_i(t) - d_i(t) \quad i = 1..M;\ t = 1..T \qquad (2)$$

$$Sp_i(t) = Sr_i(t) I_i(t) \quad i = 1..M;\ t = 1..T \qquad (3)$$

$$I_i(t) \leq C_i \quad i = 1..M;\ t = 1..T \qquad (4)$$

$$I_i(t) \geq L_i \quad i = 1..M;\ t = 1..T \qquad (5)$$

$$\sum_{i=1}^{M} q_i(t) \leq Q \quad t = 1..T \qquad (6)$$

$$\sum_{i=0}^{M} X_{ij}(t) = \sum_{i=0}^{M} X_{ji}(t) \quad j = 1..M;\ t = 1..T \qquad (7)$$

$$q_i(t) = H_i - (I_i(t-1) - Sp_i(t-1) - d_i(t)) \quad i = 1..M;\ t = 1..T \qquad (8)$$

$$X_{ij}(t) \in \{0,1\} \qquad i = 1..M\,; j = 1..M\,; i \neq j\,;\; t = 1..T \tag{9}$$

$$Sr_i(t) \in \{0\%, \ldots, 100\%\} \qquad i = 1..M\,; t = 1..T \tag{10}$$

$$T, M \in \{0, 1, 2, 3, \ldots\} \tag{11}$$

$$h_i, d_i(t), Q, C_i, I_i(t), L_i, M_i, q_i(t) \geq 0 \tag{12}$$

The objective function is shown in Eq. 1, where the total cost consist of inventory cost, reject cost and delivery cost. Equations 2 to 12 show the model constraints. Stock quantity in period t depend on quantity of stock from previous period, number of rejected stock, incoming and outgoing product (Eq. 2). Eq. 3 shows rejected quantity is equal to rejected rate times quantity of stock. Maximum stock quantity every period cannot overcome store capacity (eq. 4). Stock quantity in every store every period must be bigger than minimum stock (5). Delivery quantity of each vendor is equal to capacity delivery to all store (6). Whenever there is delivery from *i* to *j*, then the vehicle will outbound from *j* (7). Eq. 8 shows delivery quantity when number of stock less than the maximum stock.

Genetic Algorithm

Genetic algorithm used in this paper is a simple GA with:

a. Chromosome representation

Chromosome represents three variables which are minimum stock, maximum stock, and routing for each period. Minimum and maximum stocks are represented using integer values as shown in Figure 1. Notation for the minimum stock is L_i and the maximum stock is M_i.

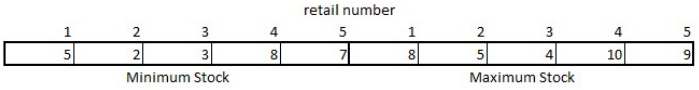

Figure 1. Minimum and maximum stock chromosome

The third variable is delivery routing for each period. A chromosome is represented by integer values that show the sequence of the store that are visited by the vehicle. When one store is not visited due to enough stock, then the chromosome is represented by zero (0). Chromosome for vehicle routing can be seen in Figure 2.

		Retail Number				
		1	2	3	4	5
period	1	0	1	0	3	2
	2	1	0	2	3	0
	3	2	0	0	1	3
	4	0	0	1	2	3
	5	4	2	5	3	1

Figure 2. Chromosome representation for vehicle routing

b. Fitness function and selection

The GA fitness function is derived from equation 1 and parents selection is using roulette wheel rule where chromosome with less fitness value has a higher possibility to be chosen as parents.

c. *Crossover*

The *Crossover* method that is used in this paper is a one-point crossover.

d. *Mutation*

The Mutation process is done inside of one chromosome where each cell has 40% possibility to be mutated. When a cell is chosen to be mutated, it changes randomly between a specific minimum and maximum values.

e. *Elitism*

Elitism is a process to keep the best chromosome in each generation automatically become an offspring in the next generation.

f. *Stopping criteria*

Stopping criteria set the GA method to be stopped. In this paper stopping criteria is using a predetermined number of generations.

Particle Swarm Optimization

Particle Swarm Optimization algorithm works as particles move together to follow the positions that have been found so far. Some important things that have to be set up to get good PSO are particle representation, position, velocity, fitness function, global best, and local best.

a. Particle representation

Particle representation for minimum and maximum stock is similar to chromosome representation in GA, however, vehicle routing representation is different. PSO uses float values instead of the sequence as shown in GA. Particle representation for vehicle routing is shown in Figure 3. The sequence of the vehicle will follow the particle from the lowest to the highest values where value 0 shows that the retail is not visited at that period. For example route for the vehicle in period one in Figure 3 is from the vendor to stores 4-2-5 and return to vendor.

		Retail Number				
		1	2	3	4	5
Period	1	0.0000	0.0304	0.0000	0.2966	0.8210
	2	0.1087	0.0000	0.4285	0.4634	0.0000
	3	0.9760	0.0000	0.9267	0.7501	0.7309
	4	0.0000	0.0000	0.8430	0.6561	0.7943
	5	0.0656	0.3006	0.8366	0.8283	0.6171

Figure 3. Particle representation of vehicle routing

b. Particle velocity

Particle velocity will be updated at every iteration to move every particle closer to the best particle in local and global position. The velocity for each particle can be updated using equation 12.

$$v_i^{k+1} = wv_i^k + c_1 rand_1 \times (pbest_i - p_i^k) + c_2 rand_2 \times (gbest - p_i^k) \quad (12)$$

Where the gbest is the best particle position for all previous iteration and pbest is the position of a particle from the previous iteration.

c. Particle position

The later position of each particle is moved with his velocity as shown in equation 13.Particle position

Later position of each particle is moved with his own velocity as shown in equation 13.

$$p_i^{k+1} = p_i^k + v_i^{k+1} \quad (13)$$

d. Fitness value

The fitness value is similar to the GA fitness value, where the fitness value is derived from equation 1.

e. The best solution and stopping criteria

The best solution is derived form the best solution from the last iteration where the number of iteration is determined at advanced.

A NUMERICAL EXAMPLE AND RESULT

The numerical example uses the main data from data generation. There are two types of demand, the first case is dynamic demand and the second case is static demand. Demand data is generated uniformly from 20-60. The other data such as distance, inventory cost, warehouse capacity at each store, initial stock, delivery capacity, and product price are generated consecutively 10, 5, uniform [20 - 50], uniform [10 - 25], uniform [60 - 100], uniform [60 - 100], 750, and 40.

We set varies of population size and the number of iterations to get the best parameter for the Genetic Algorithm for both cases. The best fitness function for case 2 is shown in Figure 4.

Figure 4. The best fitness value for case 2 with 250 Iteration and 140 population

Figure 4 shows that the GA is not trapped to local optimal easily. The two cases show that at least the solutions convergent at the 200th generation. We set the number of generations is equal to 250 to guarantee that the solution has been convergent and the best solution is 18.65% less than the initial fitness value. Therefore the GA result in significant improvement compares to the initial solution.

For the PSO there are 32 combinations of the population (P), iteration (G), and cases. The best solution for case 1 is derived from 250 iterations and 140 population. The best fitness values for case 1 is shown in Figure 5. The solutions show that the longest iteration for getting the best fitness values convergent is 198 iteration, therefore we set the number of iteration is 250 to guarantee that the best fitness value has been convergent. The best fitness value of PSO is 32.14% better than the initial solution.

Figure 5. The PSO best fitness value for case 1 with 250 Iteration and 140 population

The best solution for case 1 and case 2 for GA and PSO are shown in Table 1. The table shows that the PSO outperforms GA in terms of the best fitness value and computation time, therefore we use PSO to get management insight of static and dynamic demand.

Table 1. The optimal values and running time of GA and PSO

	Optimal Cost ($)		Running Time (S)	
	GA	**PSO**	**GA**	**PSO**
Case 1	45123.0	44132.4	3311	2850
Case 2	41297.2	41312.4	3281	2659

Table 2 shows a comparison between case 1 with dynamic demand and case 2 with static demand. The table shows when demand is static, the holding cost is less than dynamic demand however the static demand has higher spoilage cost and delivery cost. The total cost for static demand is less than the total cost of dynamic demand. When demand is dynamic, stores have to keep more stock more stocks to prevent lost sales. Since the results of the model support general finding, the model and the method are verified. The dynamic demand results in a 9.1% higher inventory cost than the static demand. Therefore, it is important for organizations to keep demand as stable as possible in each period to reduce total inventory cost.

Table 2. Fitness values for case 1 and case 2

Case 1			**Case 2**		
Holding cost	$	35362.6	Holding cost	$	32421.4
Spoilage Cost	$	8032.0	Spoilage Cost	$	8096.0
Transportation Cost	$	737.8	Transportation Cost	$	795.0
Penalty Cost	$	0.0	Penalty Cost	$	0.0
Total cost	$	**44132.4**	**Total cost**	$	**41312.4**

A sensitivity analysis is used to evaluate the effect of spoilage rate to the total cost. We use spoilage rate 5%, 7%, and 9% and keep all parameters at the same values. The sensitivity analysis result is shown in Table 3.

Table 3. Fitness values for varies of spoilage rate

Spoilage Rate 5%			**Spoilage Rate 7%**			**Spoilage Rate 9%**		
Holding cost	$	23382.4	Holding cost	$	24292.0	Holding cost	$	25069.6
Spoilage Cost	$	3840.0	Spoilage Cost	$	4824.0	Spoilage Cost	$	5376.0
Transportation Cost	$	808.0	Transportation Cost	$	902.0	Transportation Cost	$	699.0
Total cost	$	**28030.4**	**Total cost**	$	**30028.0**	**Total cost**	$	**31144.6**

Table 3 shows an increasing 2% spoilage rate from 5% to 7% and 9% result in increasing holding cost from 3% to 4%, and increasing the total cost from 3.7% to 7.2%. It shows that the spoilage rate significantly affect the holding cost and the total cost, therefore this model is significantly useful to optimize total inventory cost for items with high spoilage rate such as vegetables, fruits, and meats. For the set parameter values determined in this numerical example, the holding cost is the highest cost for the total values. This model shows that spoilage rate has

significant contribution to the total cost, therefore management has to keep spoilage rate as low as possible. Tools or machines for keeping low spoilage rate and variation such as refrigerator, refrigeration truck, vacuum packaging and drying machine are important to be applied for all business related with spoilage items. This finding is useful to support decisions and strategies for some business in developed countries like Indonesia where managements reject to invest in machines and technologies to keep items fresh and reduce spoilage rate. They think total inventory cost for spoilage items are not too significant compare to the investment cost. The results of this paper show that dynamic demand and spoilage rate are significantly affect total inventory cost, therefore cold storage and other equipment should be invested to reduce items spoilage rate.

CONCLUSION

Inventory routing problem is one important model to be used in the vendor manage inventory scheme, where the vendor delivers and keeps his stock to some retail stores. In this paper, an IRP with dynamic demand and spoilage items are developed since spoilage items such as fruits and vegetables are common. Instead of considering static demand, this paper considers dynamic demand. The model is an NP-hard problem therefore Genetic Algorithm and Particle Swarm Optimization are developed to solve the problem. Both methods are effective to solve IRP problems. A numerical example is used to compare the performance of both methods. The results show that the PSO outperforms GA in terms of solution quality and computation time. The result also show that the total cost for dynamic demand is 9% higher than the total cost of static demand. A sensitivity analysis is conducted to analyst the effect of spoilage rate to the total cost. The sensitivity analysis shows that the spoilage rate significantly affects the total cost. The numerical example and sensitivity analysis show that this model is significantly important to minimize the total inventory cost for items with high spoilage items and dynamic demand. Spoilage rate is significantly affect total inventory cost, therefore it is important for business to invest in some machines to keep low spoilage rate and variation. Since spoilage rate significantly affects the total inventory cost, savings on inventory cost could be higher than cold storage investment cost on plausible time. This paper assumes that there is no transshipment between stores, therefore the next research can consider transshipment since transshipment is common to be used by some retail stores to reduce inventory cost. The other future research can be done by considering environmental issues for delivering items.

REFERENCES

[1] Aghezzaf E-H., Raa B., & Landeghem H.H. (2006). Modeling inventory routing problems in supply chains of high consumption products, European Journal of Operational Research, 169, 1048-1063.

[2] Azadeh, A., Elahi, S., Farahani, M. H., & Nasirian, B. (2017). A genetic algorithm-Taguchi based approach to inventory routing problem of a single perishable product with

transshipment. *Computers & Industrial Engineering, 104*, 124-133. doi:10.1016/j.cie.2016.12.019

[3] Coelho L.C., Cordeau J.F., & Laporte G. (2014). Thirty years of inventory routing, Transportation Science, 48 (1), 1-19.

[4] Guimarães, T., Coelho, L., Schenekemberg, C., & Scarpin, C. (2019). The two-echelon multi-depot inventory-routing problem. *Computers & Operations Research, 101*, 220-233. doi:10.1016/j.cor.2018.07.024

[5] Hiassat, A., Diabat, A., & Rahwan, I. (2017). A genetic algorithm approach for location-inventory-routing problem with perishable products. *Journal of Manufacturing Systems, 42*, 93-103. doi:10.1016/j.jmsy.2016.10.004.

[6] Huang S-H., & Lin P-C., (2010). A modified ant colony optimization algorithm for multi-item inventory routing problems with demand uncertainty, Transportation Research Part E, 46, 598-611.

[7] Hu, W., Toriello, A., & Dessouky, M. (2018). Integrated inventory routing and freight consolidation for perishable goods. *European Journal of Operational Research, 271*(2), 548-560. doi:10.1016/j.ejor.2018.05.034.

[8] Ketzenberg, M., Gaukler, G., & Salin, V. (2018). Expiration dates and order quantities for perishables. *European Journal of Operational Research, 266*(2), 569-584. doi:10.1016/j.ejor.2017.10.005

[9] Liu S-C., & Lee W-T. (2011). A heuristic method for the inventory routing problem with time windows, Expert Systems with Applications, 38, 13223-13231.

[10] Norouzi, N., Sadegh-Amalnick, M., & Alinaghiyan, M. (2015). Evaluating of the particle swarm optimization in a periodic vehicle routing problem. *Measurement, 62*, 162-169. doi:10.1016/j.measurement.2014.10.024.

[11] Rau H., Budiman S.D., and Widyadana G.A., Optimization of the multi-objective gree cyclical inventory routing problem using discrete multi-awarm PSO method, Transportation Research Part E:Logistics and Transportation Review, 120, 51-75.

[12] Rohmer, S. U. K., Claassen, G. D. H., & Laporte, G. (2019). A two-echelon inventory routing problem for perishable products. *Computers & Operations Research, 107*, 156-172. doi:10.1016/j.cor.2019.03.015.

[13] Sadeghi, J., Sadeghi, S., & Niaki, S. T. A. (2014). Optimizing a hybrid vendor-managed

inventory and transportation problem with fuzzy demand: An improved particle swarm optimization algorithm. *Information Sciences, 272*, 126-144. doi:10.1016/j.ins.2014.02.075

[14] Savelsbergh M. and Song J.H. (2007). Inventory routing with continuous moves, Computers & Operations Research, 34, 1744-1763.

[15] Widyadana G.A., and Irohara T., (2019) Modelling multi-tour inventory problem for deteriorating items with time windows, Scienta Iranica, 26(2), 932-941.

[16] Yadollahi, E., Aghezzaf, E.-H., Walraevens, J., Raa, B., & Claeys, D. (2019). Evaluating approximate solution models for the stochastic periodic inventory routing problem. *Journal of Manufacturing Systems, 50*, 25-35. doi:10.1016/j.jmsy.2018.11.001

Response to reviewer comments Paper 19

Reviewer 1

1. Abstract is not clear and dos not appeal to read the paper.
   Answer:

We have revised the abstract and we try to show research gap, problem significance, methods and the results in the abstract.

Inventory routing problems (IRP) are one of an important tool to be used for implementing vendor manage inventory. Many researchers try to develop methods for solving inventory routing problem, however, only a few of them develop methods for inventory routing problems for spoilage items. In reality, many items are deteriorated and spoil during transportation and storage period, but not many papers deal with them since they are hard to be modeled and solved. In this paper, we develop a model and methods to solve the inventory routing problem for deteriorating items with dynamic demand and spoilage rate. The model are more realistic since many commodities such as fruits and vegetables have dynamic demand and spoilage rate. A Genetic Algorithm and Particle Swarm Optimization are developed to solve the problem in a specific planning period since the problem in an Np-hard problem. A numerical example for dynamic demand and static demand and sensitivity analysis are conducted to verify the model and to get management insights. The results show that PSO outperform GA in this model. The other finding support general hypothesis that the dynamic demand has higher total inventory cost than the static demand. The sensitivity analysis shows that increasing spoilage rate significantly affect the total cost, therefore the model is significantly useful to be used to minimize total inventory cost for IRP with dynamic demand and spoilage items.

2. there are no key words does not seems to be appropriate

Answer: I am sorry for the mistake, keywords have been added

3. Reference [1]is refereed twice with different author names in literature survey

   Answer:
   Thank you for detail observation, we have revised it.

4. Contribution of authors is not written systematically

   Answer:
   The contribution of the authors has been rewritten as below:

Hu et.al. [7] developed a simple IRP for perishable items and they developed decomposition and local search methods as efficient methods for solving the problem. The decomposition and local search is an efficient method, however to get more effective solution, metaheuristic methods can

be applied. A Genetic Algorithm is used by [2] to solve an IRP problem with perishable items and single vendor. They extended IRP model by setting transshipment from one store to the other stores. A similar model and method for perishable items was developed by [5], however, they did not consider transshipment between stores. Widyadana and Irohara [15] extended IRP models for perishable items by considering deteriorated items and items are delivered under specific time windows. In the model, items are not only deteriorated during storing period in warehouses but the items are also deteriorating during the transportation period. The model are extended by [11], where they considered multi-objectives by regarding environmental issues in their model instead of one objective only.

In this model, we developed an IRP great model developed by [2] and introduce a new model for solving more realistic condition. We use dynamic demand instead of static demand and dynamic spoilage rate since difficult to predict spoilage rate for agriculture commodities such as vegetables, meats and fruits. We develop a model that is more realistic to be applied for agriculture items.

5. General theory of GA and PSO is mentioned
   Answer:
   The general theory of GA and PSO have been included in model development.

6. All the tables and results are in picture format
   Answer:
   Sorry for format mistake, all tables and results have been changed to table format

7. Units for numerical data is missing
   Answer:
   Units of numerical data have been added

8. Transportation cost is not considered which need to be included in any MRP
   Answer:
   The transportation cost has been included in the model

Table 2. Fitness values for case 1 and case 2

Case 1		
Holding cost	$	35362.6
Spoilage Cost	$	8032.0
Transportation Cost	$	737.8
Penalty Cost	$	0.0
Fitness Value	$	**44132.4**

Case 2		
Holding cost	$	32421.4
Spoilage Cost	$	8096.0
Transportation Cost	$	795.0
Penalty Cost	$	0.0
Fitness Value	$	**41312.4**

A sensitivity analysis is used to evaluate the effect of spoilage rate to the total cost. We use spoilage rate 5%, 7%, and 9% and keep all parameters at the same values. The sensitivity analysis result is shown in Table 3.

Table 3. Fitness values for varies of spoilage rate

Spoilage Rate 5%		**Spoilage Rate 7%**		**Spoilage Rate 9%**	
Holding cost	$ 23382.4	Holding cost	$ 24292.0	Holding cost	$ 25069.6
Spoilage Cost	$ 3840.0	Spoilage Cost	$ 4824.0	Spoilage Cost	$ 5376.0
Transportation Cost	$ 808.0	Transportation Cost	$ 902.0	Transportation Cost	$ 699.0
Fitness Value	**$ 28030.4**	**Fitness Value**	**$ 30028.0**	**Fitness Value**	**$ 31144.6**

9. Structure of sentences are not appropriate at many places
   Answer:
   We have tried to rewrite some sentences

10. There is no concrete interpretation or conclusion made from the model
    Answer:
    The concrete interpretation and conclusion is derived from sensitivity analysis of the model. The interpretation can be derived when the model is applied using numerical example and sensitivity analysis. Interpretation and conclusion from numerical example and sensitivity analysis have been used in many papers.

11. Application and usage of the model and results for managerial point of view are not discussed
    Answer: We have revised the paper by adding managerial points.

This model shows that spoilage rate has high contribution to the total cost, therefore management has to keep spoilage rate as low as possible. Tools or machines for keeping low spoilage rate and variation such as refrigerator, refrigeration truck, vacuum packaging and drying machine are important to be applied for all business related with spoilage items. This finding is useful to support decisions and strategies for some business in countries like Indonesia where managements resistance to invest in machines and technologies. They think total inventory cost for spoilage items are not too significant compare investment cost.

Revisi 2

UNIVERSITAS KRISTEN PETRA

I Gede Agus Widyadana <gede@petra.ac.id>

article for special issue

2 messages

yujor <yujor@fon.bg.ac.rs> Mon, Dec 28, 2020 at 9:06 PM
To: gede@petra.ac.id

Respected Authors,

please send the missing files, figures and tables. Check the article because we did the correction of your English.

Best regards,
Branka Mladenovic
Publishing manager of YUJOR

Article2-Widyadana.pdf
265K

I Gede Agus Widyadana <gede@petra.ac.id> Thu, Dec 31, 2020 at 2:53 PM
To: yujor <yujor@fon.bg.ac.rs>

Dear Branka Mladenovic,

Herewith I send the missing figures and tables, thank you.

Best regards,
G A Wiyadana
[Quoted text hidden]

6 attachments

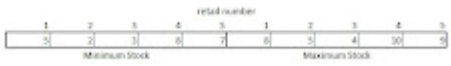

Figure 1.jpg
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Figure 2.jpg
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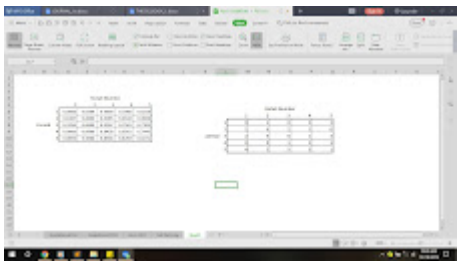

Figure 3.jpg
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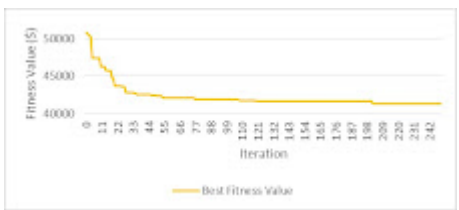

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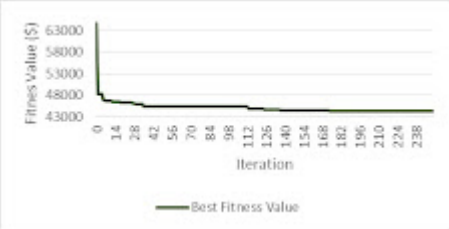

Figure 5.jpg
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Tables yujor widyadana_001.jpg
136K

Penerimaan

UNIVERSITAS KRISTEN PETRA

I Gede Agus Widyadana <gede@petra.ac.id>

articles are posted

1 message

yujor <yujor@fon.bg.ac.rs> Tue, Jan 12, 2021 at 8:51 PM
To: subhityagi7@gmail.com, gede@petra.ac.id, nitahshah@gmail.com, sunitasharmav78@gmail.com, aliashaikh@math.buruniv.ac.in, vivekrajput.du.aor@gmail.com

Respected Authors,

your articles are posted on our site. To access them, please go to

http://yujor.fon.bg.ac.rs/index.php/yujor/issue/view/63

Best regards and happy New Year,
Branka Mladenovic

Yugoslav Journal of Operations Research
xx (xxxx), Number nn, zzz–zzz
DOI: https://doi.org/10.2298/YJOR200516037W

AN INVENTORY ROUTING PROBLEM FOR DETERIORATING ITEMS WITH DYNAMIC DEMAND AND SPOILAGE RATE

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Abstract: Inventory routing problems (IRP) are among important tools to be used for implementing vendor manage inventory. Many researchers try to develop methods for solving inventory routing problem, however, only a few developed methods for inventory routing problems for spoilage items. In reality, many items are deteriorated and spoiled during transportation and storage period. In this paper, we developed a model and methods to solve the inventory routing problem for deteriorating items with dynamic demand and spoilage rate, i.e., demand varies and items spoil during planning periods. Those cases are more realistic since many commodities such as fruits and vegetables have dynamic demand and spoilage rate. A Genetic Algorithm and Particle Swarm Optimization are developed to solve the problem with various demands in a specific planning period since the problem is Np-hard. A numerical example and sensitivity analysis are conducted to verify the model, and to get management insight it. The result is interesting and support general hypothesis that dynamic demands result in higher inventory cost than the static demands, and the increasing demand results in increasing inventory cost. Also, the results show that increasing demand and deteriorating rates significantly affect

the total cost, therefore, the developed model is important and significantly useful to be used for solving IRP with dynamic demand and spoilage items.

Keywords: Inventory, Spoilage, Dynamic Demand, Genetic Algorithm, Particle Swarm Optimization.

MSC: 65K10.

1. INTRODUCTION

Inventory Routing Problem deals with inventory and distribution issues since both costs are dominant costs in the supply chain, ([4] and [12]). Therefore, many organizations try to streamline stock holding and transportation expenses. The IRP is an optimization inventory problem considering transportation costs so to minimize transportation and inventory cost [16]. More than 30 years, researchers have payed their attention to the IRP and gave various models and solutions, see [3]. The IRP model that includes IRP with the continuous move was introduced by [14]. Aghezzaf and Landeghem [1] developed IRP with multi-tours, and then stochastic demand IRP was introduced by [6], and Liu et.al. [9] developed an IRP model with time windows.

Recently, many IRP models consider perishable items, which have a random lifetime regarding environmental conditions, e.g., temperature and humidity, the uncertainty of transportation time, and harvest time [8]. Hu et.al. [7] developed a simple IRP for perishable items using decomposition and local search methods. Decomposition and local search are efficient methods, however, to get a more effective solution, metaheuristic methods can be applied. A Genetic Algorithm is used by [2] to solve an IRP problem with perishable items and single vendor. They extended IRP model by setting transshipment from one store to another stores. A similar model, and amethod, for perishable items was developed by [5], however, they did not consider transshipment between stores. Widyadana and Irohara [15] extended IRP models for perishable items by considering deteriorated items and items delivered under specific time windows. In the model, items are not only deteriorated during storing period in warehouses but are also, deteriorating during the transportation period. The model is extended by [11], where they considered multi-objectives by regarding environmental issues instead of only one objective.

In this model, we further developed an IRP great model from [2] and introduced a new model for solving more realistic conditions. We use dynamic demand instead of static demand, and a dynamic spoilage rate, since it is difficult to predict spoilage rate for agriculture commodities such as vegetables, meat, and fruits. We developed a model that is more realistic to be applied for agriculture items. As the problem is an NP-hard, therefore Genetic algorithm and Particle Swarm Optimization are used to solve it. Genetic Algorithm is an effective method used for solving IRP problems ([2] and [5]). The other effective metaheuristic method used to solve NP-hard problems is Particle Swarm Optimization ([14] and [10]).

2. MODEL DEVELOPMENT

We developed the Inventory routing model, using [2], with dynamic demand and spoilage rate. Some assumptions of this model are:

- Demand rate distribution during the replenishment period (T) is known.
- Deteriorating rate during replenishment period (T) is known Yellow

In this model, we assume that there is one product, one vendor, and one delivery player within a multi-period. Notations are:

Parameters:

h_i : Inventory cost at store I (\$)

T : Replenishment period

M : Numbers of store

$d_i\ (t)$: Delivery volume from store i at period t

$Sr_i\ (t)$: Deteriorating rate in store i at period t

$Sp_i\ (t)$: Number of reject in store i at period t

Q : Delivery capacity (unit)

c_{ij} : Delivery cost from store i to store j (\$)

C_i : warehouse capacity at store i

Pr : Product price (\$)

$I_i\ (0)$: Initial stock in store i

Variables

L_i : Minimum stock in store i H_i : Maximum stock in store i

$X_{ij}(t)$: $\begin{cases} 1, \text{ if product delivered from store } i \text{ to store } j \\ 0, \text{ otherwise} \end{cases}$ $q_i(t)$: Product quantity delivered to store i at period t

$$MinZ = \sum_{t=1}^{T}\sum_{i=1}^{M} h_i I_i(t) + Pr\sum_{t=1}^{T}\sum_{i=1}^{M} Sp_i(t) + \sum_{t=1}^{T}\sum_{i=1}^{M}\sum_{j=i+1}^{M} c_{ij} X_{ij}(t) \tag{1}$$

Constraints:

$$I_i(t) = I_i(t-1) - Sp_i(t-1) + q_i(t) - d_i(t) \quad i = 1..M; t = 1..T \tag{2}$$

$$Sp_i(t) = Sr_i(t)\, I_i(t) \quad i = 1..M; t = 1..T \tag{3}$$

$$I_i(t) \le C_i \quad i = 1..M; t = 1..T \tag{4}$$

$$I_i(t) \ge L_i \quad i = 1..M; t = 1..T \tag{5}$$

$$\sum_{i=1}^{M} q_i(t) \le Q \quad t = 1..T \tag{6}$$

$$\sum_{i=0}^{M} X_{ij}(t) = \sum_{i=0}^{M} X_{ji}(t) \quad j = 1..M; t = 1..T \tag{7}$$

$$X_{ij}(t) \in \{0, 1 \quad i = 1..M; j = 1..M; i \ne j; t = 1..T \tag{9}$$

$$Sr_i(t) \in \{0\%, \ldots, 100\% \quad i = 1..M; t = 1..T \tag{10}$$

$$T, M \in \{0, 1, 2, 3, \ldots \tag{11}$$

$$h_i, d_i(t), Q, C_i, I_i(t), L_i, M_i, q_i(t) \geq 0 \tag{12}$$

The objective function is shown in Eq. 1, where the total cost consists of inventory cost, reject cost, and delivery cost. Equations 2 to 12 show the model constraints. Stock quantity in period t depends on the previous period stock quantity, number of rejected stock, incoming and outgoing product (Eq. 2). Eq. 3 shows that the rejected quantity is equal to rejected rate times quantity of stock. Maximum stock quantity cannot overcome store capacity (eq. 4). Stock quantity in every store in every period must be bigger than the minimum stock (5). Delivery quantity of each vendor is equal to capacity delivery to all stores (6). Whenever there is delivery from i to j, the vehicle will outbound from j (7). Eq. 8 shows delivery quantity when the number of stock is less than the maximum stock.

2.1. Genetic Algorithm

Genetic algorithm used in this paper is a simple GA with:

1. Chromosome representation

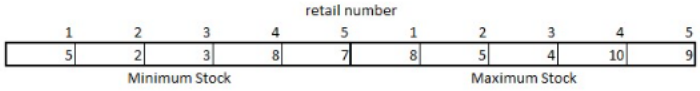

Figure 1: Minimum and maximum stock chromosome

Chromosome represents three variables, i.e., minimum stock, maximum stock, and routing for each period. Minimum and maximum stocks are represented using integer values as shown in Figure 1. Notation for the minimum stock is L_i and the maximum stock is M_i.
The third variable is delivery routing for each period. A chromosome is represented by integer values that show the sequence of the store visited by the vehicle. When one store is not visited, the chromosome is represented by zero (0). A chromosome for vehicle routing can be seen in Figure 2.

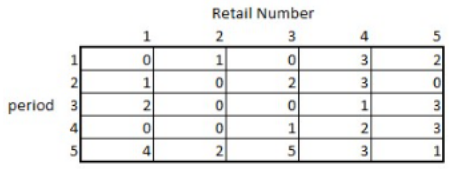

Figure 2: Chromosome representation for vehicle routing

2. Fitness function and selection

   The GA fitness function is derived from equation 1, and parents selection is using roulette wheel rule where chromosome with lower fitness value has a higher possibility to be chosen as a parent.

3. *Crossover*

   The *Crossover* method that is used in this paper is a one-point crossover.

4. *Mutation*

   The Mutation process is done inside of one chromosome where each cell has 40% possibility to be mutated. When a cell is chosen to be mutated, it changes randomly between a specific minimum and maximum values.

5. *Elitism*

   Elitism is a process to keep the best chromosome in each generation automatically, it become an offspring in the next generation.

6. *Stopping criteria*

Stopping criteria sets the GA method to be stopped. In this paper stopping criteria is a predetermined number of generations.

2.2. Particle Swarm Optimization

Particle Swarm Optimization algorithm works as particles move together to follow the positions that have been found so far. Some important things that have to be set up to get good PSO are particle representation, position, velocity, fitness function, global best, and local best.

1. Particle representation

   Particle representation for minimum and maximum stock is similar to chromosome representation in GA, however, vehicle routing representation is different. PSO uses float values instead of the sequence as shown in GA. Particle representation for vehicle routing is shown in Figure 3. The sequence of the vehicle will follow the particle from the lowest to the highest values, where value 0 shows that the retail is not visited at that period. For example, the route for the vehicle in period one in Figure 3 is from the vendor to stores 4-2-5 and the return to vendor.

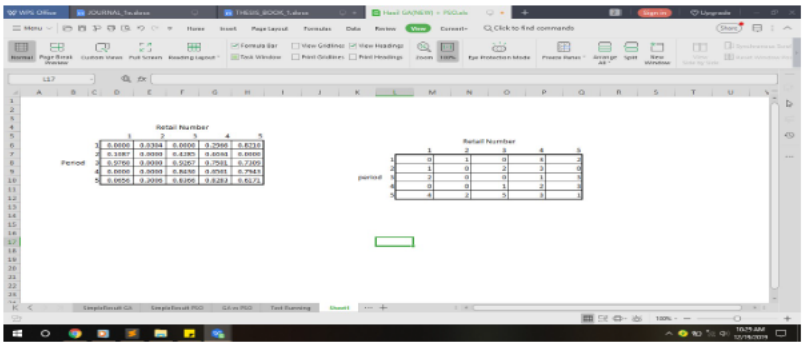

Figure 3: Particle representation of vehicle routing

2. Particle velocity

   Particle velocity will be updated at every iteration to move every particle closer to the best particle in local and global positions. The velocity for each particle can be updated using equation 12.

$$v_i^{k+1} = wv_i^k + c_1 rand_1 \times \left(pbest_i - p_i^k\right) + c_2 rand_2 \times \left(gbest - p_i^k\right) \quad (12)$$

   Where the gbest is the best particle position for all previous iterations, and pbest is the position of a particle from the previous iteration.

3. Particle position
   The later position of each particle is moved with its velocity as shown in equation 13.Particle position

   Later position of each particle is moved with its own velocity as shown in equation 13.

$$p_i^{k+1} = p_i^k + v_i^{k+1} \quad (13)$$

4. Fitness value

   The fitness value is similar to the GA fitness value, where the fitness value is derived from equation 1.

5. The best solution and stopping criteria

The best solution is derived form the best solution from the last iteration, where the number of iterations is determined in advanced.

3. A NUMERICAL EXAMPLE AND RESULT

The numerical example uses the main data from data generation. There are

two types of demand; the first case is dynamic demand and the second case is static demand. Demand data are generated uniformly from 20-60. The other data such as distance, inventory cost, warehouse capacity at each store, initial stock, delivery capacity, and product price are generated consecutively; 10, 5, uniform [20 - 50], uniform [10 - 25], uniform [60 - 100], uniform [60 - 100], 750, and 40.

We set varies population sizes and the number of iterations to get the best parameter for the Genetic Algorithm for both cases. The best fitness function for case 2 is shown in Figure 4.

Figure 4: The best fitness value for case 2 with 250 Iterations and 140 population

Figure 4 shows that the GA is not trapped to local optimal easily. The two cases show that, at least, the solutions convergent at the 200th generation. We set the number of generations equal to 250 to guarantee that the solution has been convergent and the best solution is 18.65% less than the initial fitness value. Therefore, the GA results in a significant improvement compared to the initial solution.

For the PSO there are 32 combinations of the population (P), iteration (G), and cases. The best solution for case 1 is derived from 250 iterations and 140 population. The best fitness values for case 1 is shown in Figure 5. The solutions show that the longest iteration for getting the best fitness values convergent is 198 iterations, therefore we set the number of iterations to be 250 to guarantee that the best fitness value has been convergent. The best fitness value of PSO is 32.14% better than the initial solution.

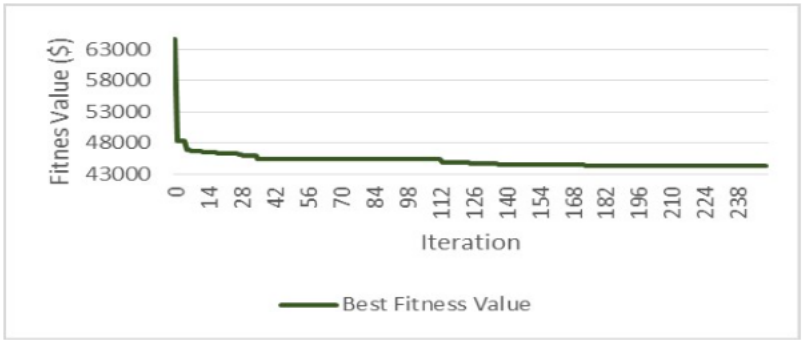

Figure 5: The PSO best fitness value for case 1 with 250 Iterations and 140 population

The best solution for case 1 and case 2 for GA and PSO are shown in Table 1. The Table shows that the PSO outperforms GA in terms of the best fitness value and computation time, therefore, we use PSO to get management insight of static and dynamic demands.

Table 1. The optimal values and running time of GA and PSO

1*	Optimal Cost ($)		Running Time (S)	
	GA	**PSO**	**GA**	**PSO**
Case 1	45123	44296.6	3311	2850
Case 2	41297.2	41058.6	3281	2659

3.1. Table 2 shows a comparison between case 1 with dynamic demand and case 2 with static demand. The Table shows that dynamic has less inventory cost but higher spoilage cost and delivery cost However, the spoilage and delivery costs are not significant. Case 1 has a higher cost than case 2 since stores have to keep more stocks to prevent lost sales. The dynamic demand results in a 9.1% higher inventory cost than the static demand. Therefore, it is important for organizations to keep demand as stable as possible, in each period, to reduce inventory cost.

Table 2. Fitness values for case 1 and case 2

Case 1		**Case 2**	
Holding cost	$ 35362.6	Holding cost	$ 32421.4
Spoilage Cost	$ 8032.0	Spoilage Cost	$ 8096.0
Transportation Cost	$ 737.8	Transportation Cost	$ 795.0
Penalty Cost	$ 0.0	Penalty Cost	$ 0.0
Total cost	$ **44132.4**	**Total cost**	$ **41312.4**

A sensitivity analysis is used to evaluate the effect of spoilage rate to the total cost. We use spoilage rate 5% , 7% , and 9% and keep all parameters at the same values. The sensitivity analysis result is shown in Table 3.

Table 3. Fitness values for varies of spoilage rate

Spoilage Rate 5%		**Spoilage Rate 7%**		**Spoilage Rate 9%**	
Holding cost	$ 23382.4	Holding cost	$ 24292.0	Holding cost	$ 25069.6
Spoilage Cost	$ 3840.0	Spoilage Cost	$ 4824.0	Spoilage Cost	$ 5376.0
Transportation Cost	$ 808.0	Transportation Cost	$ 902.0	Transportation Cost	$ 699.0
Total cost	$ **28030.4**	**Total cost**	$ **30028.0**	**Total cost**	$ **31144.6**

Table 3 shows an increasing 2% spoilage rate form 5% to 7% , resulting in increasing holding costs from 3% to 4% , and increasing the total cost from 3.7% to 7.2% . It shows that the spoilage rate significantly affect holding cost and spoilage cost. Therefore, this model is suitable to be used for items with high spoilage cost such as vegetables, fruits, and meat. For the set parameter values determined in this numerical example, the holding cost is the highest cost for the fitness values. This model shows that spoilage rate has high contribution to the total cost, therefore, management has to keep spoilage rate as low as possible. Tools or machines for keeping low spoilage rate and variation such as refrigerator, refrigeration truck, vacuum packaging, and drying machines are important to be applied for all business related with spoilage items. This finding is useful to support decisions and strategies for some business in countries like Indonesia, where managements resist to invest in machines and technologies. They think that total inventory cost for spoilage items are not too significant compared to investment cost.

4. CONCLUSION

Inventory routing problem model is important to be used in the vendor manage inventory scheme, where the vendor delivers and keeps his stock to some retail stores. In this paper, an IRP for spoilage items is developed since spoilage items are common in reality. Instead of considering static demand, this paper considers dynamic demand. The model is an NP-hard, therefore Genetic Algorithm and Particle Swarm Optimization are developed to solve it. Both methods are effective, and a numerical example is used to compare their performances.The results show that the PSO outperforms GA in terms of solution quality and computation time, and the total cost for dynamic demand is 9% higher than the total cost of static demand. A sensitivity analysis is conducted to analyst the effect of spoilage rate to the total cost. It shows that the spoilage rate significantly affects the total cost. The numerical example and sensitivity analysis show that this model should be used to handle spoilage items and dynamic demand. Increasing of spoilage rate significantly affects total inventory cost, therefore it is important for business to invest in some tools or machines to keep low spoilage rate and variations. Savings on inventory cost could be higher than machines investment cost on plausible time. This paper assumes that there is no transshipment between stores, therefore, the next research can consider transshipment since it is commonly used by some retail stores to reduce costs. The other future research by considering environmental issues for delivering items.

Acknowledgement: This research has been supported by Miniistry of Education and Cultural of Indonesia, Fundamental Research Grant (002/SP2H/AMD/LT/MULTI/L7/2020).

REFERENCES

[1] Aghezzaf E-H., Raa B., & Landeghem H.H. (2006). Modeling inventory routing problems in supply chains of high consumption products, European Journal of Operational Research, 169, 1048-1063.

[2] Azadeh, A., Elahi, S., Farahani, M. H., & Nasirian, B. (2017). A genetic algorithm-Taguchi based approach to inventory routing problem of a single perishable product with transshipment. *Computers & Industrial Engineering, 104*, 124-133. doi:10.1016/j.cie.2016.12.019

[3] Coelho L.C., Cordeau J.F., & Laporte G. (2014). Thirty years of inventory routing, Transportation Science, 48 (1), 1-19.

[4] Guimarães, T., Coelho, L., Schenekemberg, C., & Scarpin, C. (2019). The two-echelon multi-depot inventory-routing problem. *Computers & Operations Research, 101*, 220-233. doi:10.1016/j.cor.2018.07.024

[5] Hiassat, A., Diabat, A., & Rahwan, I. (2017). A genetic algorithm approach for location-inventory-routing problem with perishable products. *Journal of Manufacturing Systems, 42*, 93-103. doi:10.1016/j.jmsy.2016.10.004.

[6] Huang S-H., & Lin P-C., (2010). A modified ant colony optimization algorithm for multi-item inventory routing problems with demand uncertainty, Transportation Research Part E, 46, 598-611.

[7] Hu, W., Toriello, A., & Dessouky, M. (2018). Integrated inventory routing and freight consolidation for perishable goods. *European Journal of Operational Research, 271*(2), 548-560. doi:10.1016/j.ejor.2018.05.034.

[8] Ketzenberg, M., Gaukler, G., & Salin, V. (2018). Expiration dates and order quantities for perishables. *European Journal of Operational Research, 266*(2), 569-584. doi:10.1016/j.ejor.2017.10.005

[9] Liu S-C., & Lee W-T. (2011). A heuristic method for the inventory routing problem with time windows, Expert Systems with Applications, 38, 13223-13231.

[10] Norouzi, N., Sadegh-Amalnick, M., & Alinaghiyan, M. (2015). Evaluating of the particle swarm optimization in a periodic vehicle routing problem. *Measurement, 62*, 162-169. doi:10.1016/j.measurement.2014.10.024.

[11] Rau H., Budiman S.D., and Widyadana G.A., Optimization of the multi-objective gree cyclical inventory routing problem using discrete multi-awarm PSO method, Transportation Research Part E:Logistics and Transportation Review, 120, 51-75.

[12] Rohmer, S. U. K., Claassen, G. D. H., & Laporte, G. (2019). A two-echelon inventory routing problem for perishable products. *Computers & Operations Research, 107*, 156-172. doi:10.1016/j.cor.2019.03.015.

[13] Sadeghi, J., Sadeghi, S., & Niaki, S. T. A. (2014). Optimizing a hybrid vendor-managed inventory and transportation problem with fuzzy demand: An improved particle swarm optimization algorithm. *Information Sciences, 272*, 126-144. doi:10.1016/j.ins.2014.02.075

[14] Savelsbergh M. and Song J.H. (2007). Inventory routing with continuous moves, Computers & Operations Research, 34, 1744-1763.

[15] Widyadana G.A., and Irohara T., (2019) Modelling multi-tour inventory problem for deteriorating items with time windows, Scienta Iranica, 26(2), 932-941.

[16] Yadollahi, E., Aghezzaf, E.-H., Walraevens, J., Raa, B., & Claeys, D. (2019). Evaluating approximate solution models for the stochastic periodic inventory routing problem. *Journal of Manufacturing Systems, 50*, 25-35. doi:10.1016/j.jmsy.2018.11.001